ELECTRICAL WORLD

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ELECTRICAL WORLD

A consolidation of Electrical World, Electrical Engineer and American Electrician

What in the World!

No action on the St. Lawrence treaty at this session of Congress. One who wishes to take the measure of today's statesmanship should read the Congressional Record pages devoted to St. Lawrence discussion. What a mixture of politics, economics, assumption and sectional interest! An interim only, for it will be up again for Congressional action.

•

Edison Electric Institute will have its convention June 4. We hope the program will deal frankly with many industry problems. Above everything else, however, we welcome the opportunity for utility men to get together again for the sake of renewing old friendships and swapping stories of personal and business experiences.

•

David Harum would be in his element in the dicker now going on between T.V.A. and electrical appliance manufacturers. After bids were open T.V.A. said, in effect, "Well, we will take the range price until August 1, but you must go back and lower the refrigerator prices." Perhaps T.V.A. will land a retail price of $125 for a range and refrigerator combination. We suggest that quality be considered more carefully.

•

Sales campaigns are getting under way. New lines of appliances are out, some of them streamlined. Meetings are being held in all sections to pep up the sales forces. Good work. Take advantage of the consumer dollars now rattling around in consumer pockets.

•

Yes, we read about that train to be driven by radio-transmitted power, but we haven't seen it yet. Who knows, we may—some day.

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March 24, 1934

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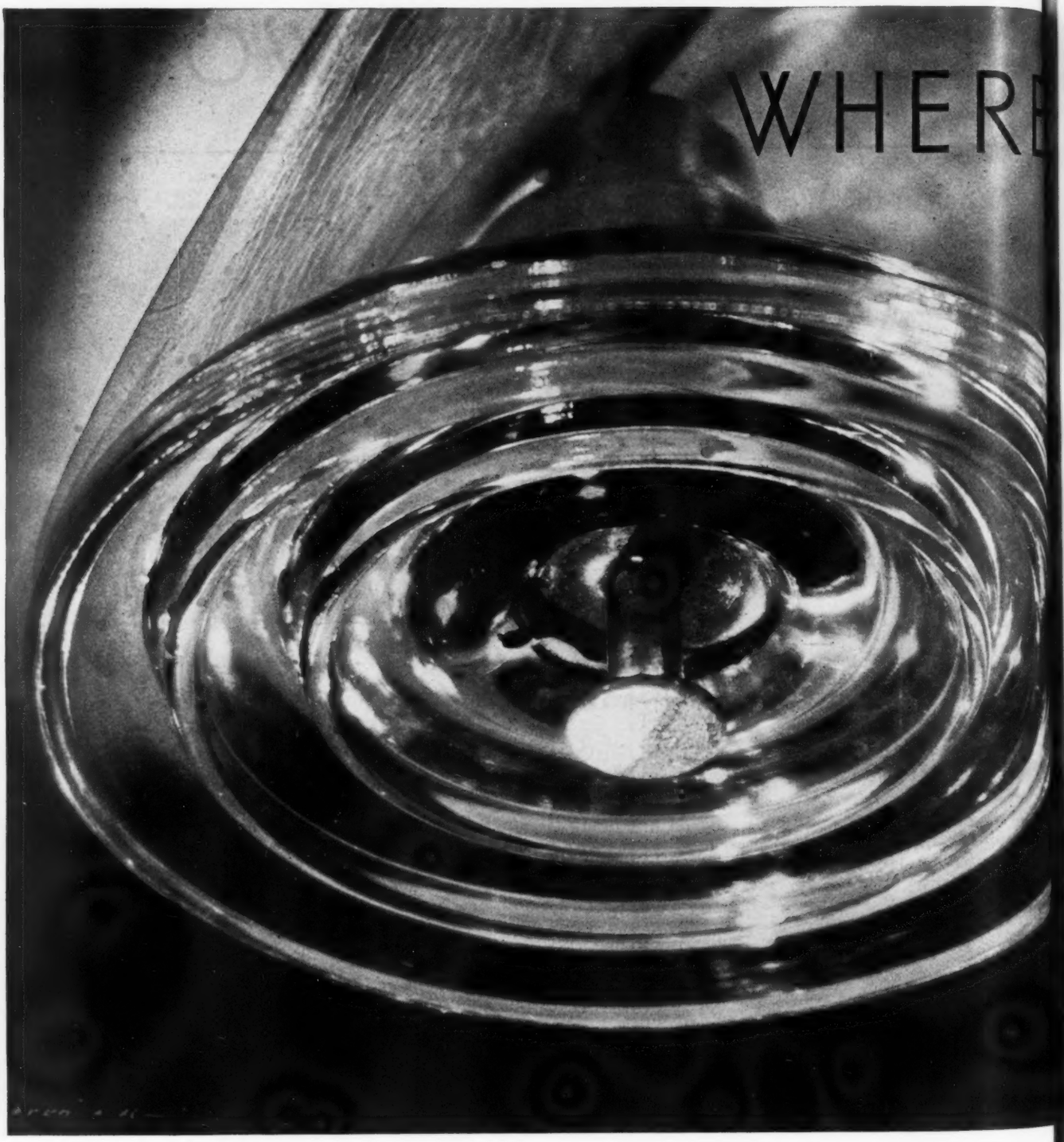

CORNING LABORATORIES have likewise removed the hazards of operation from other industries where this removal has meant widespread importance in point of safety and better operation. In such fields as railroad and marine signalling, airway beacons, etc., the scientific development of special glasses giving purer color indications, greater visibility at night, greater resistance to temperature changes are but representative of the work of Corning Laboratories for scores of industries.

ELECTRICAL WORLD

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for the Week Ending

March 24, 1934

L. W. W. MORROW, *Editor*

Time to Tackle Costs of Distribution

TWO important and parallel avenues lie before American industry on the way back to economic recovery. One is that of increased sales of manufactured products without first reducing their prices; the other is that of increased sales at lower costs to the purchaser. To continue along the present road means to encounter sustained resistance to sales with a low consumer purchasing power, all-too-slowly increasing. To shift to the parallel road means a rigorous self-examination by industry of the price which consumers must pay. In short, what are the possibilities of reducing costs to the consumer? In all manufacturing the wages paid average but 17 per cent of the factory value of the manufactured products. The average cost of direct labor and materials there is of the order of one-sixth of the sales price. Modernization through labor, power or material savings is almost a fractional economy operation.

The place to look for appreciable cost reduction is between the factory and the ultimate purchaser—in the cost of distribution. In the case of a $4,500 motor car, $2,000 may be expended in direct and indirect sales expense, while direct labor and materials account for but $600. Similarly, the $200 electric refrigerator may require $100 to sell, whereas labor and materials total scarcely more than $40. Is this money spent to secure distribution an irreducible margin? Must distribution always absorb nearly half of the consumer's dollar? No one knows. Distribution costs have never been worked out as have other costs. No one has subjected single product distribution costs to detailed analysis of various methods of securing sales, to see which might be the most economical as well as the most effective in selling. Industry needs to study distribution, not factory costs.

If this cost of distribution can be reduced, a corresponding increase in volume of business can be had through the effect of lower sales prices. For example, where 1,000,000 refrigerators a year find a market at an average $200 price, nearly 3,000,000 could probably be placed at $100 because of the characteristics of consumer markets and the effect of lower prices. Every Ford car is a lesson in that.

IT IS high time that the healthy spirit of change, which today motivates America, be applied to one of its greatest problems. A new approach to distribution methods and principles is urgently called for. A successful, lower-cost-to-the-consumer solution would mean greatly increased business for consumer goods industries and renewed vigor to capital goods industries. The latter, struggling along on an estimated 30 per cent of normal production and employment, will not go far without a demand for their products based on needs of the former. After all, factories must be busy if they are to be able to buy new equipment, and factories are busy when sales are made. When, as in the electrical industry, an unsaturated consumer market with ample purchasing power is faced, the answer to revival in manufacturing is sales, and then more sales.

WOLF

After a year of doldrums, power company sales managers held one of their old-time two-day conferences in Chicago last week. It was interesting from two angles. There was more confidence and purpose reflected than has been seen since the old working committees of the N.E.L.A. were broken up. The formal program provided a stimulating review of market opportunities and selling plans. But the thing that everybody wanted to talk about was T.V.A. What will it mean to rates, appliance prices, future policies? What are the lessons in it—so far? These topics were out of the picture, however, except as they were discussed in private.

There is so much still indefinite in the government's power program that the whole situation is uncertain. One thing is sure, however, the public will continue to be served. The use of electricity will increase. The development of the market will go on. This is a great business. The prevailing jitters will subside. Adjustments will be made. Sound business policies will find the answers to present perplexities.

Therefore, just because fear thrives on secrecy and repression, these things should be openly talked about. Out of it will come clearer thinking, better planning, stronger selling.

STRADDLE

When all is said, the electric range offers to build profitable load in more places than any other appliance. The business waits on power company policy. Earl Fisher of San Francisco put his finger on it at the E.E.I. sales managers' meeting when he branded as "Roman riders" the combination companies which hold back electric cooking to protect gas. The whole industry suffers, because this has blocked public acceptance of the idea in many of the larger cities, where public opinion puts down its roots; so electric cooking just doesn't get started.

The best thing that ever happened to the electric lighting industry was the Welsbach gas mantle. Its competition brought the tantalum, tungsten and "Mazda" lamps. And these developments, in turn, drove gas into the kitchen. Progress followed in each case. But interference with the free promotion and sale of electric ranges holds back both industries and progress.

There is only one sound policy for the combination utility, and that is to sell both gas and electric ranges aggressively and let the customer decide. And this factor in the situation should be faced right now if more domestic load is to be developed. The small appliance campaign planned for this summer will help, but the range is the key to the present problem. And "Roman riders" can't go far.

LIGHTNING

Interruptions to service and damage to equipment from lightning still persist despite an increase in knowledge of the phenomena and the development of protective equipment and methods. It is possible to get complete protection, but too frequently this is not economical and the engineers adopt a compromise. In some instances terminal substations are completely shielded as well as the line, but the expense of overhead and underground shields are comparable to the expense of the service equipment itself. One compromise is to put ground wires on the line and shield wires on the substations and this practice is favored for steel tower lines. Another interesting development consists in building lines and equipping them with discharge tubes on or below each insulator or insulator string. The theory is that these will take care of flashovers in one half cycle and thus prevent damage or interruption to service. Another practice is to use surge absorbers, lightning arresters or relief gaps in several places or combinations.

The difficulty is to measure results obtained by the several methods in economic and service terms. There is no consistency in the behavior of lightning as regards magnitude of stroke or location of stroke or frequency of stroke occurrence. The subject reduces to the theory of probability unless complete shielding protection is decided upon. Recently, however, some new and interesting developments offer promise of cost reduction in protection. Primarily the endeavor is to lay out a system so that any link may be disconnected and reconnected instantly. This requires very quick-acting and instantaneously reclosing breakers. The principle is to open a line when lightning strikes and then close it again after the very small time interval required to dissipate the lightning. In theory the line would need no protection and the terminal equipment can be protected by simple dead grounded relief gaps. Experience to date has been very satisfactory, but not conclusive. More and more experience with present methods is required to evaluate protection in terms of dollars and service.

Only Industry Selling Will Beat Yardsticks and Taxes

No matter the immediate problem, be it federal or municipal competition or yardsticks, be it rate agitation or regulatory pressure, be it new laws or refunding conditions, the answer is the same.

Only increased volume of business will make prosperity possible for light and power enterprise.

That can only be had by intensive selling of service and, directly or indirectly, of energy-using equipment.

The only questions are, "How soon?" and "Why not now?"

By GEORGE E. WHITWELL*

Vice-President in Charge of Sales, Philadelphia Electric Company

PRIVATELY owned and operated utilities can lower residence rates materially only as load is built sufficiently to warrant reductions. We cannot, like the government, establish highly unprofitable, low residential rates that it is hoped some day will be profitable when adequate consumption has been obtained. We have no almost limitless source of money—for example, taxation—upon which to draw to offset the loss that would be entailed through a process of cutting rates to a point which would induce sufficient consumption to produce profit only after an unknown number of years. Yet today's residence rates in my own company, including that for water heating, permit a cost per kilowatt-hour decidedly comparable with the cost which would result from the announced rates of the Tennessee Valley Authority, provided *full use* consumptions could be actually made to exist both in the territory of the Philadelphia Electric Company and in that of the Tennessee Valley Authority.

We, therefore, feel that we can withstand successfully comparisons with governmental yardsticks of *average* residence rates provided we can build load as fast as, or faster than, the Tennessee Valley Authority. In order to build up this average residence consumption emphasis must be laid upon the sale of the three major electric load-building appliances, namely, the refrigerator, the range and the water heater. The refrigerator alone will not produce the desired result. There must be a reasonably rapid saturation of ranges and water heaters.

Not only must we secure a reasonably rapid saturation of the major appliances, but we must make every effort to induce customers to continue the use of appliances already purchased but perhaps out of service due to the need for some minor repair. This is more of a problem than many of us think. We promote appliances, we do everything to foster their acceptance and use, but, with the exception of the major appliances which presumably will be used due to the amount invested in them by the customer, do we know that the electric iron, toaster, grill, waffle iron, vacuum cleaner, washer and the host of other smaller appliances are in regular use?

Top rate reduced along with average

There is one other phase of the problem, however, that does not deal with *average* residence rates, but deals with the *top step or block* in the residence rate. It is desirable, if not necessary, to reduce the top block simultaneously with the reduction in average cost. At present the top block in the residence rates of the Tennessee Valley Authority calls for 3 cents per kilowatt-hour, with a minimum. This is appreciably lower than the top block in the residence rates of practically all electric utility companies in the United States. It is not conceivable that a top block of 3 cents produces even the operating expenses of serving the small-use residence customer. In fact, in the case of the Philadelphia Electric Company, with a minimum charge of 75 cents, which includes the use of 10 kw.-hr., and with a second block of 5½ cents, 47 per cent of all residence customers do not pay their fair share of operating expenses plus a return of 7 per cent on the investment allocated to serve

*Excerpts from paper presented before midwinter sales conference of Pennsylvania Electric Association, Pittsburgh, late last month.

them, and 14 per cent of all residence customers do not use enough electricity to pay the operating expense created by them. If top blocks are to be cut, only two paths are open:

1. To cut them arbitrarily, thereby increasing the unprofitableness of half of our residence customers, with such deficits made up by the larger use or profitable customers (generally those to whom manufacturers, jobbers and dealers must naturally sell lighting, refrigerators, oil burners, washers, cleaners, ranges and water heaters) or

2. To attempt to increase the use of these unprofitable customers through the sale to them of relatively low-priced small heating and lighting devices which will increase the consumption per year of each of these unprofitable customers by perhaps 100 to 200 kw.-hr.

Low-price devices for limited-income customer

The first of these paths is distinctly unbusinesslike and is unfair to the user of profitable quantities of electricity and to the dealers, jobbers and manufacturers who should not be unnecessarily handicapped in the selling of equipment to the profitable electricity user. The second of these paths is worth attempting to follow, although conceivably it can only be followed if the electrical industry agrees that it is in its own best interests to inaugurate certain merchandising practices which, in the past, have been considered undesirable and unnecessary.

Presumably, a very large percentage of the 240,000 unprofitable electric customers of my own company are people of extremely limited incomes. It would appear, therefore, that, by and large, appliances of low selling price—for example, $5 or under—but with fairly high annual consumption of electricity—for example, 100 to 200 kw.-hr.—should be sold to this group of customers by some sort of a local industry mass-selling program which would offer to the dealer, as nearly as may be, the same advantages as those which the utility would have in its own mass-selling program.

Five-point program to meet yardsticks

TO ATTEMPT to solve this problem of meeting government yardsticks for rates, of paying the tax bills which will fall to our lot and of taking care of additional expenses resulting from the National Industrial Recovery Act, I propose a five-point residential sales program, each point of which is independent of the others—all five points, however, to be carried on simultaneously if maximum results are to be obtained.

Point No. 1, Electric Refrigerators—Final figures for 1933 show that 47,100 domestic electric refrigerators were connected to our lines during 1933. Yet, even with these known sales of refrigerators and with the sales of all other appliances, the average annual kilowatt-hours of consumption per domestic customer of the Philadelphia Electric Company increased only eighteen in 1933, as compared with 1932, whereas the consumption from these refrigerators alone, assuming no replacements, should have produced more than twice this result. It, therefore, follows that sharp losses were experienced in connection with other residence uses for electricity during the time that these refrigerators were being added to the system.

Theoretically, about 56,500 refrigerators (over and above replacements) added to the system would produce enough revenue to compensate for a reduction, in the second block of the residence rate of the Philadelphia Electric Company, of ½ cent, or from 5½ to 5 cents per kilowatt-hour. The net addition of 76,000 more refrigerators would compensate for a reduction in the second block of from 5 to 4½ cents. Such compensation, however, would occur only if none of these refrigerators were replacements and if there was no tendency on the part of the new users of refrigerators to make up, by curtailment of other residential electricity uses, for the increase in electricity use due to the operation of the refrigerator. There is no assurance that this number of refrigerators can be sold, even in part, to our present unprofitable residence customers. The sale of the first 56,500 refrigerators would have to be generally to those having incomes of from $2,700 to $3,500 per year, and the additional 76,000 would have to be sold to those having incomes of from $2,100 to $2,700 per year.

The refrigerator is a very necessary device in any sales program, but it alone can bring only a partial solution to the present sales problem.

Point No. 2, Electric Ranges—The electric range is absolutely essential in connection with any program that is to build rapidly the average consumption of the residence user. It probably is of little or no value in reducing the number of unprofitable residence consumers. When, however, the problem becomes one of increasing, by three or four times, the present average annual residence consumption per customer, which in Philadelphia is 645 kw.-hr., the 1,500 kw.-hr. used annually by an average electric cooking customer cannot be anything but an absolute essential in the load-building activity.

A four-burner, 16-in. oven range is available this year which can be retailed, after a full merchandising markup, for less than $100, and which appears to be subject to fewer servicing difficulties than those which have been experienced heretofore. Most important of all, there are in rapid development certain radical changes in connection with electric range design and construction that should in the very near future result in still lower prices and still more favorable operation.

There has, therefore, been prepared as point No. 2 for Philadelphia a comprehensive local industry electric range selling campaign. It is not too much to hope that this campaign will result in the addition to our connected residence load of somewhere around 5,000 ranges. Such a number of ranges would produce a consumption of about 7,500,000 kw.-hr. per year. Each 350 ranges would increase the kilowatt-hour consumption per domestic customer by 1 kw.-hr.

Point No. 3, Electric Water Heaters—Without question, the most rapid load builder among today's tried electrical appliances is the water heater. A water heater will average about 4,000 kw.-hr. per year. Each 130 put on the lines of the Philadelphia Electric Company will increase the annual average consumption per residence customer by 1 kw.-hr.

The electric water heater will not tend to make profitable any customers now unprofitable; it can be sold only where income is sufficient to pay for the device, plus about $40 a year average for its use. Its market can be materially widened, however, through the adoption of a rental or trial installation plan.

Point No. 4, Small Appliances—Negotiations are now under way with the other branches of the Philadelphia electrical industry looking toward the adoption of some

sort of mass selling of small heating and lighting appliances to the present unprofitable residence customers. Examples of such appliances are the non-automatic iron, the percolator, the non-automatic toaster, the cord set and the "Pin-It-Up" type of lamp. A card record is now being made of the name and address of each of the 240,000 present unprofitable residence customers.

A proposal under which these customers would be sold small heating and lighting appliances under extremely liberal credit terms, by a special crew of Philadelphia Electric Company men, has been presented to the dealers. Under this plan the dealers would be offered financing by us on the same basis that we are offering such financing to our customers—this dealer financing to be limited each month to a single featured item. The manufacturers and dealers had certain objections to offer in connection with the plan and are now preparing a counter-proposal for our consideration. A program of this character will, of course, not do a great deal to increase average residential consumption per customer per year, but, by reducing the number of unprofitable residence customers, should go toward making possible a succession of reductions in either the pricing of, or number of, kilowatt-hours in the second block in our residential rate.

Point No. 5, Miscellaneous Electric Merchandising—No selling program, to provide a solution to the problem as stated, could be complete unless it contemplated continuous and aggressive selling and continuing use of lighting, "Mazda" lamps, air conditioning and the other electrical appliances not elsewhere mentioned in this five-point program. Therefore, to round out the selling plan for 1934, point No. 5 represents the continued merchandising by the Philadelphia Electric Company, with due regard to proper dealer co-operation, of those other devices—for example, "Mazda" lamps, washers, cleaners, ironers, air conditioning and portable lamps, without the use of which no home can become completely electrical and completely conversant with the comforts, conveniences and low cost of electrical service.

Commercial sales also to be stimulated

There is little doubt but that, as changes are made which reduce the top blocks of the residence rate schedule, it will be necessary and desirable to make similar reductions in the rate applying to small commercial customers. With this in mind, most careful study and attention should be given to the development of the use of electricity by the smaller commercial group, so that this use may increase as residence use increases and similar reductions in rate may be justified.

In most companies the small commercial group represents a relatively large number of individual customers and a very great variety of possible applications for electricity. For this reason careful study should be given to determine the principal uses of electricity for this class of customer as a whole, so that these may be made the basis of special campaign activities which may be conducted with reasonable chance of success. While the salesman contacting this type of customer should be generally familiar with all of the principal applications applying to this customer group, we in the Philadelphia Electric Company have found it most advantageous to concentrate the salesman's attention on one or two applications at a time, rather than continually trying to promote a great number of applications. However, in order that each individual customer may receive the attention he deserves, we have prepared for our salesmen survey cards and handbooks. These survey cards list some 100 principal applications of electricity to commercial use and the handbook goes further in actually illustrating and giving descriptive information on some of the more important of these uses. The handbook has proved particularly helpful in giving the salesman something to put down before the customer during his sales talk in order to illustrate just what other customers of similar type are doing to promote their business or decrease their expenses by the greater use of electric service.

Profitable prospects sorted out

As the salesman uses the survey card in making the original contact with the customer, he is instructed to determine from observation and conversation with the customer the following facts:

1. Whether the customer is now, or probably will be within a period of six months, a prospect for additional electrical applications.
2. Whether the customer is apparently in a financial position to purchase additional equipment.
3. Whether or not the customer can, in the opinion of the salesman, use such additional equipment and thereby either increase his business or reduce his operating costs.

The results of the survey so far indicate that approximately one-tenth of those customers contacted are in a class which should be considered worthy of further cultivation and, therefore, appear to be potential prospects. This does not mean that these customers are now willing or ready to purchase additional equipment or that they

Mr. Whitwell summarizes the urgent need for sales

Greatly increased and continually increasing taxes, together with materially enlarged operating expenses resulting from the National Industrial Recovery Act, will have to be paid by electric utility companies at the same time that government yardsticks, regardless of whether they are fairly competitive or not, will bring upon these companies the necessity for lower average rates in order to induce more widespread use of electricity by residence and small commercial customers.

I can see no need, particularly, for bewailing the imposition of this problem. Perhaps it has been a blessing in disguise, if because of the unsoundness and injustice of the attack, the electric utility industry can obtain a much greater unity of constructive thought and action. Certainly it has been a blessing if it spurs us, who are charged with the sale of electricity, into the formulation, each for his own territory, of sound plans which, creating greater sales, will permit us to meet the problem.

have definitely expressed a desire to do so. It does mean, however, that they are in a reasonably good financial condition and that, in the opinion of the salesman, there are certain additional ways in which they could use electricity to their own advantage.

These selected customer cards are being placed in a separate file and are primarily the basis of mailing lists which are made up from time to time.

In promoting the use of electric service among those customers who are in the selected group we have found the use of the direct-mail campaign to be quite effective. Up to now campaigns have been run on the following:

(a) Store lighting.
(b) Electric ventilating equipment.
(c) Outdoor lighting.
(d) Industrial lighting.
(e) Portable electric cooking equipment.
(f) Window lighting.
(g) Air-conditioning equipment (March 15).

In special campaigns we believe we have been fortunate in the co-operation secured from the manufacturers of the equipment concerned. Prospects secured have been forwarded in rotation to points of contact designated by the co-operating manufacturers. These points of contact have included kitchen supply houses, electrical wholesalers and dealers and manufacturers' representatives. These agencies actually sell the equipment to the customer.

To summarize the activities for increasing the use of electricity by smaller commercial customers, I believe it can be stated briefly that the work divides itself into three major classifications:

1. A determination of the market to be worked.
2. A survey of this market to determine those customers who are worthy of intensive sales cultivation.
3. Selling the selected customers on the basis of campaign activities and personal follow-up.

Full Lightning Currents Attained in Laboratory

No longer feeble imitations of natural discharges, today's artificial lightning current magnitudes approximate the real thing, in tests upon electrical equipment, as voltages have done for some time

By P. L. BELLASCHI
Transformer Engineer
Westinghouse Electric & Manufacturing Company, Sharon, Pa.

High lightning voltages recorded in the field have prompted the development of surge-voltage generators capable of delivering millions of volts. Field experience has also shown unmistakably that the current discharge of a lightning stroke is just as important a characteristic of lightning phenomena as the voltage. The blowing up of fuse links, fuse cutouts, lightning arresters, Deion gaps, etc., that have been subject to a direct stroke of lightning brings home convincingly the importance of the current discharge.

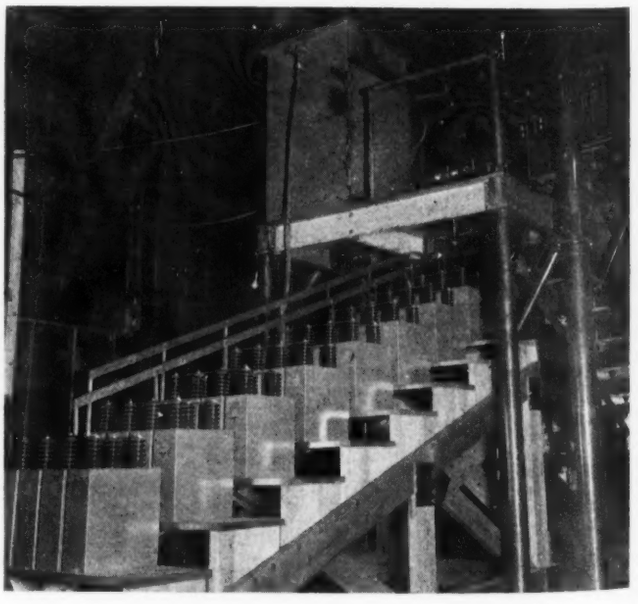
By proper design it was possible to construct a heavy-surge-current generator capable of delivering currents of 100,000 amp. and more, these having an effective duration equal to and even in excess of 100 microseconds. It was also essential to develop constant-resistance shunts of a few milli-ohms and not exceeding several millimicrohenries, to enable the current measurement of the surge currents at the cathode-ray oscillograph.* Provisions were also made for testing apparatus with normal-frequency voltage excitation and with the surge current synchronized with the crest of the normal-frequency voltage.

In making these tests considerable precaution had to be taken to protect the man and the laboratory apparatus from the destructiveness of the heavy surge current and of the large 60-cycle current that might follow the surge current in some of the tests. A steel tank inclosing the apparatus tested, shown on the platform in the accompanying illustration, was built specifically to render testing of this kind secure and easily controlled.

Briefly, the aim was to produce, measure and make possible testing with heavy surge currents that would be comparable with current discharges of lightning strokes, and this aim has been attained.

Laboratory duplicates field experience

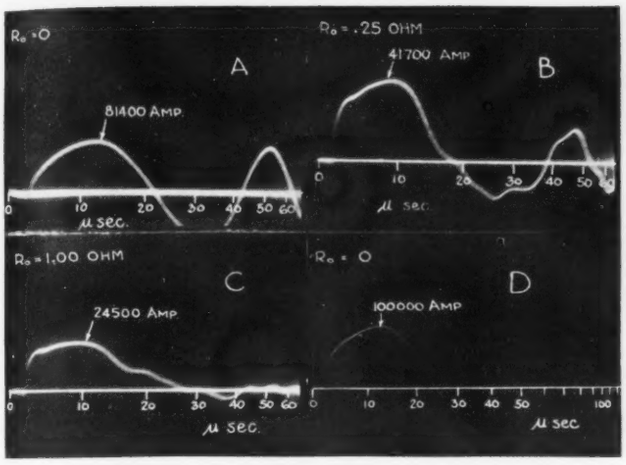
Careful and extensive investigations of lightning stroke currents on transmission lines in this country and abroad establish that lightning stroke currents range from 10,000 to 20,000 amp. up to a maximum value in the order of 150,000 amp. with a duration to one-half value of about 20 to 100 microseconds. The heavy-current strokes are naturally the most severe ones and are the ones that occur more rarely.



Heavy-surge-current generator to duplicate destructive effects of lightning

Sixty-two 100-kv., 0.25-mfd. condenser units in parallel discharge in excess of 100,000 amp. of laboratory lightning, which now approximates natural discharge.

*"*Heavy Surge Currents—Generation and Measurement*," by P. L. Bellaschi, "Electrical Engineering," January, 1934, pages 86-94.*



Heavy surge currents produced in laboratory

having rising fronts of 2 to 10 microseconds and effective durations as great as 100 microseconds to one-half crest value; currents A and D sufficient to fuse No. 14 wire; B and C show effects of inserting resistance in the discharge circuit.

One of the simplest methods to determine the effective surge current of a direct lightning stroke is to study the fusion of copper conductor carrying the current of the stroke. Experiments with lightning striking a rod connected to ground through segments of different-sized wires in series, as well as data secured from a number of cases where lightning strokes discharged to radio antennas, lead one to conclude that the current of a direct lightning stroke could be expected to fuse copper wires of No. 14 size (0.064-in. diameter) and smaller, but that larger-sized wires would ordinarily conduct the current to ground.

Many indications point out conclusively that lightning currents in the laboratory produce the same effects as in the field. The following are a few of the examples:

First—With the heavy-surge-current generator at the Sharon laboratory surge currents in excess of 100,000 amp. and of sufficient duration actually to explode a No. 14 copper wire have been produced.

Second—Comparison of field experience with direct and near-direct strokes at surge-proof distribution transformers and correlation of these findings in the field with the laboratory results has revealed that the electrodes or plugs of Deïon gaps, subject to a direct stroke of lightning, have on their surface a record or "klydonograph" figure much like that obtained in the laboratory with surge currents of 50,000 and somewhat greater. The similarity of the markings on two groups of electrodes subjected respectively, one group to the lightning currents in the field and the second group to surge currents produced in the laboratory, definitely indicate that lightning-stroke currents in the order of 50,000 amp. and more have been discharged through Deïon gaps at transformer installations hit directly by lightning.

Third—Fuse cutouts at transformer poles that were subject to direct strokes of lightning were in practically all cases shattered and completely destroyed. Similarly, fuse cutouts subjected in the laboratory to heavy surge currents in the order of 50,000 amp. and more were completely destroyed. In both cases the fuse link was of course evaporated into a cloud of gas.

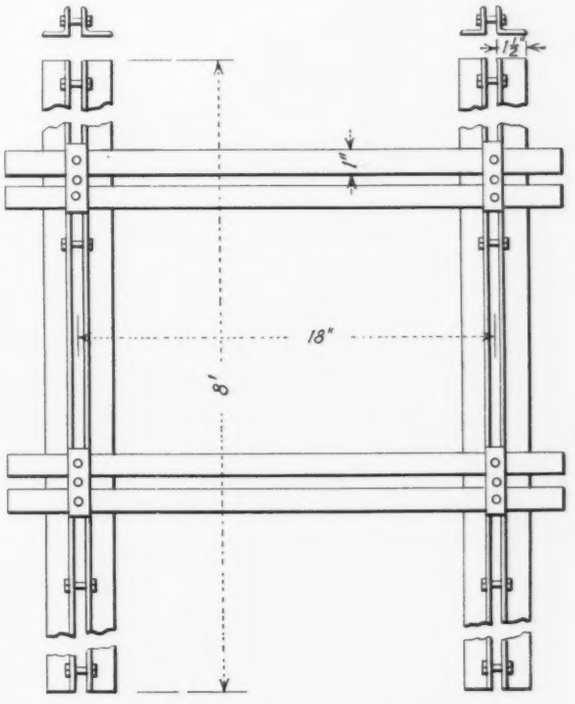
In the ten months during which the heavy-surge-current generator has been in normal operation in the laboratory the behavior and characteristics of protective apparatus in general have been studied. Particular attention has been given to the study of Deïon gaps mounted internally in surge-proof distribution transformers and these have now been developed to discharge even the heavy surge currents mentioned above.

Ladder Structure Makes Starter Base Flexible

Every new model brings problems in the automobile plant. Flexibility of production facilities is vital. Even motor starter mountings must yield.

Installation of starters for motors up to 50 and 75 hp. is a very simple matter in the automobile factory of the Studebaker Corporation at South Bend, Ind. In such plants machines are frequently moved about as manufacturing processes are changed due to new models, improvements in production routing, etc. For this reason power facilities must include in their arrangement an element of flexibility more than is usually needed in other plants. Large-diameter concrete columns in the building furnish convenient locations for motor starting and control equipment, but to sink expansion bolts every time a starter had to be hung on one of these columns would be a considerable job. To avoid this, starters and switches are mounted on ladder racks like the one shown in the accompanying sketch.

The rack rests on the floor with strap-iron ties holding it to the column. It is constructed of side members composed of two 1½-in. angles held together by spacer bolts at about 2-ft. intervals. The crosspieces of the ladder



Adjustable rack for starters and switches

are each of two flat bars 1 in. wide. These bars are clamped to the uprights with bolts and pieces as shown. The cross-pieces are movable up and down the side members to accommodate any height of starter box, while the slot between the crossbars allows any width box up to 24 in. to be attached. If necessary longer crossbars may be used to increase the width of the rack.

Auto-Transformers Reduce Light-Flicker Complaints

By A. B. JAQUITH and G. H. FIEDLER
Electric Distribution Department, Rochester Gas & Electric Corporation

More economical than additional secondary copper, the auto-transformer has come into use for correcting voltage variation when additional appliance motors are used.

Rochester Gas & Electric Company, as result of prolonged trial, is able to indicate typical voltage improvement.

Formula developed gives effect of installation on secondary system and voltage regulation, size and location of units desirable, enabling ready institution of the practice elsewhere.

UTILITIES are receiving numerous complaints of flickering lights in residential areas caused by the starting of 120-volt motors on domestic appliances. The number of motors is increasing every year with the increased sale of electric refrigerators, oil burners, air-conditioning equipment, etc., and if the use of appliances is to be encouraged it is necessary to maintain adequate service. Hence, secondary systems, which give satisfactory service for conditions of steady load and are even of sufficient capacity to provide for several years load growth, are inadequate if voltage changes caused by motor starting are not sufficiently limited to prevent the occurrence of objectionable flicker. Thus, the distribution engineer is faced with the problem of adequately adapting secondaries to meet this requirement as economically as possible.

The following typical example illustrates the effect on consumers' voltage caused by the starting of small motors. A secondary line 1,000 ft. long, composed of three No. 2 copper conductors, spaced 8 in., supplies 40 houses with a total resultant load of 10 kva. Neglecting the line transformer, the voltage drop caused by this steady load, in the line alone, to the last customer is 3.6 per cent. A 1/3-hp., 120-volt motor starting at the end of the line drawing 25 amp. at 50 per cent power factor causes a drop in voltage of 6.8 per cent, and the result is objectionable flicker to more than half the customers on the line. Further consideration shows that any motor starting more than 500 ft. away from the supply transformer causes greater drop in the last 500 ft. of line than is caused by the entire steady load at the last service, and the sudden drop is objectionable, whereas the normal drop is unnoticed.

Auto-transformer corrects the flicker

Installation of an auto-transformer is suggested as the ideal method for limiting voltage fluctuations on secondaries which are otherwise adequate. For example, consider the above-described line with a 2-kva. auto-transformer, having an *IR* drop of 0.8 per cent and an *IX* drop of 0.4 per cent, installed at the end of the line. The voltage drop with the motor starting at the end of the line is now reduced to 2.5 per cent and the maximum drop at any point on the line with any motor location is 2.7 per cent. Thus, the installation of an auto-transformer has reduced the voltage fluctuation from 6.8 per cent to 2.7 per cent, or 60 per cent, and the great improvement to service has been accomplished by the use of a small, relatively inexpensive device readily installed without any line rearrangement or interruption to service.

To determine the current relations and resultant voltage in a secondary system on which an auto-transformer is employed it is convenient to use the formulas developed at the end of the article. By application of the formulas to the typical example mentioned above curves showing performance of the system are plotted on Fig. 1. Curves 5, 6 and 7 are performance curves of No. 2 copper lines with 2-kva. auto-transformers, of impedances as noted, installed 1,000 ft. from the line transformer. Values taken from curve 6 are used throughout the following discussion and curves 5 and 7 are given only to indicate the effect of auto-transformer impedance on voltage drop. The curves are extended to show that the auto-transformer is properly located at the end of the line due to the effect of 120-volt transmission beyond the unit.

Readily to compare the relative improvement gained by changing conductor size with an auto-transformer installation curves 1, 2, 3 and 4, which show voltage drop for conventional secondaries, are presented. Reference to the figure shows that a change in conductor size from No. 2 to No. 1 reduces drop by 11.1 per cent, to 7.3 volts; from No. 2 to No. 2/0 by 28 per cent, to 5.9 volts; from No. 2 to No. 4/0 by 36 per cent, to 5 volts, as compared to a reduction of 60 per cent, to 3.27 volts, by the installation of a 2-kva. auto-transformer.

Thus an increase in investment of more than 300 per cent in secondary copper, by the replacement of No. 2 with No. 4/0, results in less improvement than is gained by the installation of a comparatively inexpensive device. This is due to the fact that although increased copper size results in proportionately decreased resistance, the reactance is but little affected, and with low power factor starting currents the reactance drop vector is more

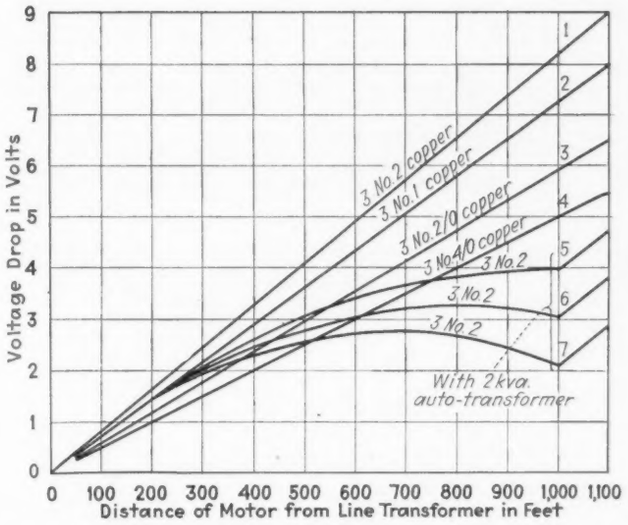


Fig. 1—Voltage drop on secondary lines much less under 120-volt motor-starting conditions with auto-transformer

Line spacing, 8 in.; motor-starting current, 25 amp. at 50 per cent power factor. Auto-transformers on curves 5, 6 and 7 are of impedance respectively: Per cent $IR = 1.57$, per cent $IX = 0.78$; per cent $IR = 0.8$, per cent $IX = 0.4$, and zero impedance.

nearly in phase with the impressed voltage than the resistance vector. Of course, losses are reduced with larger copper size and increased with the auto-transformer installation, but the increase is so small compared to the reduction in fixed charges that the choice of the method of improvement should not be affected unless conductors should be changed to correct low voltage under conditions of steady load.

To accomplish the result obtained with an auto-transformer by shortening the secondary lines reference to Fig. 1 shows that it is necessary to reduce the length of

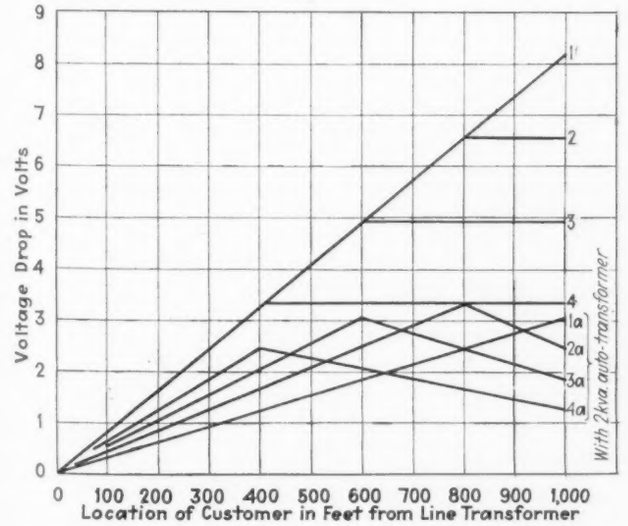


Fig. 2—Voltage drop at service taps on 120-volt motor starting on three No. 2 copper secondary lines reduced with auto-transformer

Line spacing, 8 in.; motor-starting current, 25 amp. at 50 per cent power factor. Auto-transformer on curves has per cent $IR = 0.8$ and per cent $IX = 0.4$ and is 1,000 ft. from line transformer. Motor is located at 400, 600, 800 and 1,000 ft. respectively from the line transformer in curves 4 to 1 in each group.

a No. 2 line by 60 per cent, from 1,000 ft. to 400 ft. If a combination of larger conductor and shorter run is considered the figure shows that a No. 1 line 450 ft. long, a No. 2/0 line 550 ft. long or a No. 4/0 line 660 ft. gives the same fluctuation as a No. 2 line 1,000 feet long with an auto-transformer at the end. Any such reduction in length of secondary run is always expensive, if not impossible, and the primary extensions, transformer installations and rearrangement of secondary runs result in increased capital costs, fixed charges and operating expense.

Line characteristics obtained

The advantage gained by an auto-transformer installation is not fully shown in Fig. 1 as customers are affected by motors starting at any point on the line, which will cause sufficient drop to flicker their lights, as well as those starting at their own service location. With the auto-transformer the drop is a maximum only at the point at which a motor starts, while for a conventional line the drop is constant from the motor location to the end of the line. This effect is shown in Fig. 2, which is a series of curves to compare results caused by motors starting at 400 ft., 600 ft., 800 ft. and the end of a 1,000-ft. No. 2 line with and without an auto-transformer. Note that curves 2, 3 and 4 are parallel to the axis of abscissas from the point at which the motor starts to the end of the line, while 2a, 3a and 4a slope downward from a maximum. For example, a motor starting 600 ft. from the source on a No. 2 line causes a drop in voltage of 4.9 volts to the end of the line, while an auto-transformer at the end of the line limits the drop at the motor to 3 volts and, at the end of the line, the drop is reduced to 1.8 volts or 40 per cent from the maximum.

To determine the capacity of an auto-transformer, it is necessary to consider the unbalanced load on the secondary line on which the installation is made. An unbalanced condition results in a steady load on the unit which is the determining factor in kva. rating as the instantaneous starting current is of too short duration to have appreciable heating effect. Assuming a uniform unbalance on a line by applying formula (5), the current through the auto-transformer is found to be approximately 3/8 of the total unbalanced current for lines with a large Z_0 ratio and 3/7 for small Z ratio. The effect of transformer impedance on voltage improvement as shown in Fig. 1 may make voltage regulation rather than line unbalance the important factor in the choice of transformer capacity.

Fusing desirable for auto-transformer

The auto-transformer should be fused to protect the apparatus under conditions of secondary short circuit or service trouble, as line transformer fuses are generally too large to prevent damage to a low capacity auto-transformer before clearing the main transformer. Fuses must be selected of sufficient size and proper time current characteristics to prevent blowing under motor-starting conditions. An inexpensive weatherproof block installed in the transformer leads has been found suitable. Fuse blowing causes no service interruption, but a periodical inspection of fuses is desirable to assure functioning of the device, and furthermore blown fuses may disclose a condition of unbalance which should be corrected in any event.

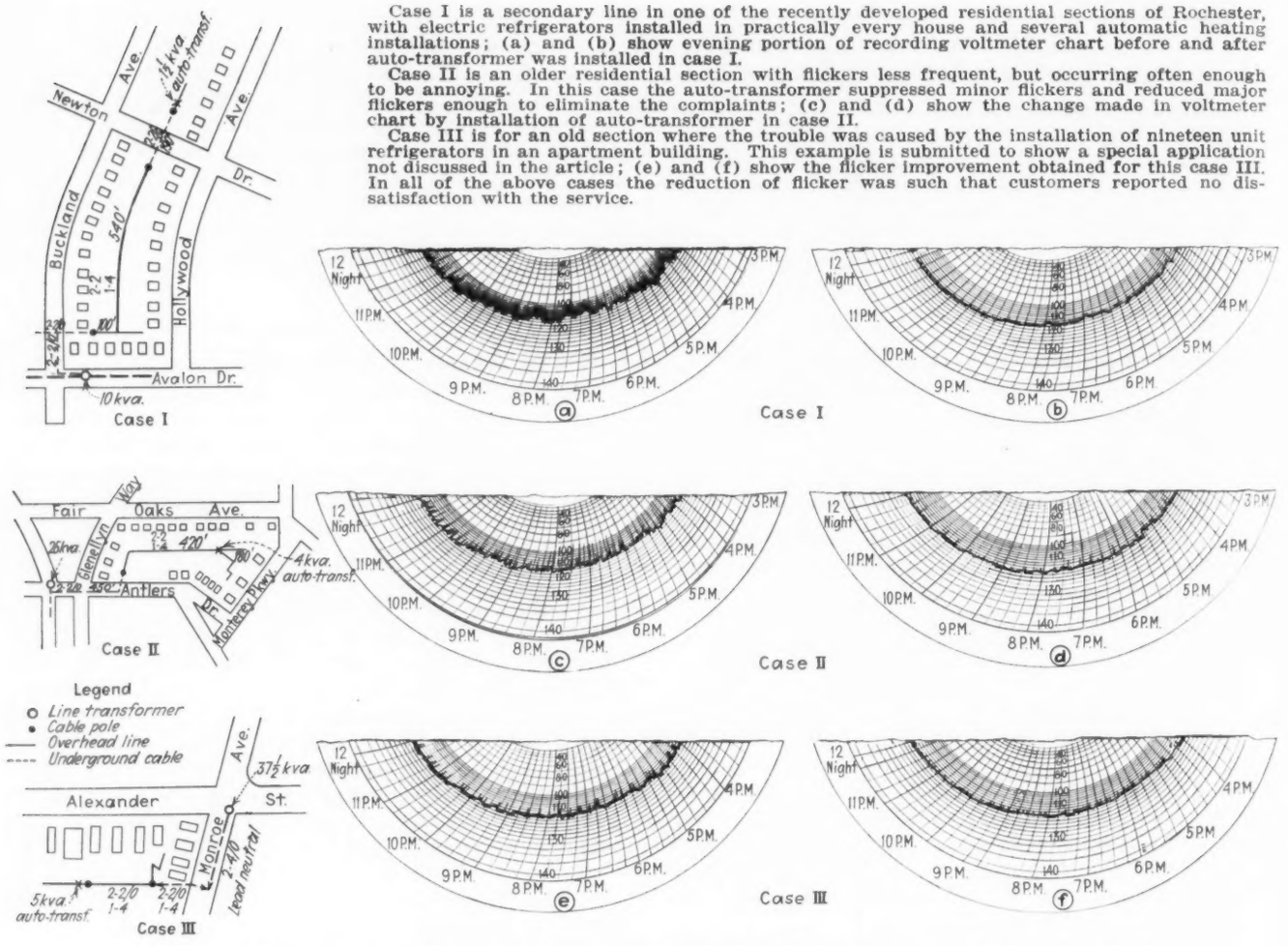
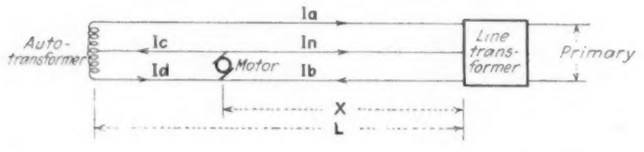

Case I is a secondary line in one of the recently developed residential sections of Rochester, with electric refrigerators installed in practically every house and several automatic heating installations; (a) and (b) show evening portion of recording voltmeter chart before and after auto-transformer was installed in case I.
Case II is an older residential section with flickers less frequent, but occurring often enough to be annoying. In this case the auto-transformer suppressed minor flickers and reduced major flickers enough to eliminate the complaints; (c) and (d) show the change made in voltmeter chart by installation of auto-transformer in case II.
Case III is for an old section where the trouble was caused by the installation of nineteen unit refrigerators in an apartment building. This example is submitted to show a special application not discussed in the article; (e) and (f) show the flicker improvement obtained for this case III. In all of the above cases the reduction of flicker was such that customers reported no dissatisfaction with the service.
Newton
Ave.
15 kva auto-transf.
Buckland
540'
Hollywood
Dr.
Avalon Dr.
10 kva.
Case I
12 Night
3 P.M.
4 P.M.
5 P.M.
6 P.M.
7 P.M.
8 P.M.
9 P.M.
10 P.M.
11 P.M.
Case I
Fair Oaks Ave.
25 kva
420'
4 kva. auto-transf.
Antlers
Monterey Blvd.
Case II
Case II
Legend
Line transformer
Cable pole
Overhead line
Underground cable
Alexander
37½ kva
St.
Monroe
2-4/0
Lead neutral
5 kva. auto-transf.
2-2/0
1-4
Case III
Case III

Fig. 3—Positive reduction of lamp flicker results from installation of auto-transformers on the lines

In order to determine the effect of an auto-transformer installation on a secondary system the formulas at the end of the article were developed. By their application the voltage regulation, size of unit required and its proper location may be determined.

For several years the Rochester Gas & Electric Corporation has used auto-transformers to correct conditions of flickering lights and the accompanying charts illustrate typical results obtained. Diagrams of the secondary systems giving physical characteristics and size of auto-transformer installed and voltage charts with and without the unit in operation are submitted for three installations. Charts for each location were taken within a few days to show that improvement is due entirely to the auto-transformer installation.

Voltage-drop formulas derived



Neglecting the effect of auto-transformer exciting current and line transformer impedance the current relations for a 2:1 auto-transformer are as follows:

$$I_c = 2\,I_a$$
$$I_d = I_a$$
$$I_n = I_m - 2\,I_a$$
$$I_b = I_m - I_a$$

z = Unit impedance per foot of 240-volt secondary wire.
Z = Impedance per 1,000 ft. of 240-volt secondary wire.
z_n = Unit impedance per foot of neutral wire.
Z_n = Impedance per 1,000 ft. of neutral wire.
Z_o = Sum of impedances of two coils of auto-transformer.
L = Distance from line transformer to auto-transformer.
X = Distance from line transformer to motor.

[All italicized quantities are vector quantities]

Then:

$$(I_m - I_a)\,z\,X + (I_m - 2\,I_a)\,z_n\,X = \frac{(I_m - I_a)}{2}\,z\,X - \frac{I_a\,z}{2}(L - X) + \frac{I_a\,Z_o}{2} + \frac{I_a\,zL}{2} + 2I_a\,z_n\,(L - X) + I_a\,z\,(L - X)$$

Solving for I_a:

$$I_a = I_m \frac{(z\,X + 2\,z_n\,X)}{(Z_o + 2\,z\,L + 4\,z_n\,L)}$$

For values of impedance per 1,000 ft. of conductor and L in feet:

$$(1)\quad I_a = I_m\left(\frac{(Z + 2\,Z_n)\,X}{1{,}000\,Z_o + 2\,Z\,L + 4\,Z_n\,L}\right)$$

Let: E_m = voltage at motor terminals.
E_l = voltage to neutral at line transformer terminals.

Then: $E_m = E_l - X\,(I_b\,z + I_n\,z_n)$
$= E_l - X\,[(I_m - I_a)\,z + (I_m - 2\,I_a)\,z_n]$

Substituting the value of I_s from (1):

$$E_m = E_t - I_m \left\{ \left[1 - \left(\frac{z\,X + 2\,z_s\,X}{Z_o + 2\,z\,L + 4\,z_s\,L} \right) \right] z\,X + \left[1 - \frac{2(z\,X + 2\,z_s\,X)}{(Z_o + 2\,z\,L + 4\,z_s\,L)} \right] z_s\,X \right\}$$

Simplifying:

$$E_m = E_t - I_m \left\{ \frac{(Z_o\,z + Z_o\,z_s + 2\,z^2 L + 6\,z_s\,z\,L + 4\,z_s^2 L)\,X}{(Z_o + 2\,z\,L + 4\,z_s\,L)} - \frac{X^2 (z^2 + 4\,z\,z_s + 4\,z_s^2)}{(Z_o + 2\,z\,L + 4\,z_s\,L)} \right\}$$

Factoring:

$$E_m = E_t - I_m \left\{ \frac{(Z_o + 2\,z\,L + 4\,z_s\,L)(z + z_s)\,X - (z + 2z_s)^2\,X^2}{(Z_o + 2\,z\,L + 4\,z_s\,L)} \right\}$$

Impedances above are per foot of conductor to change to value of Z per 1,000 ft.:

$$(2) \quad E_m = E_t - I_m \left\{ \frac{(1{,}000\,Z_o + 2\,ZL + 4\,Z_s L\,(Z + z_s)\,X - \frac{(Z + 2\,Z_s)^2\,X^2}{4\,Z_s L}}{1{,}000\,(1{,}000\,Z_o + 2\,ZL +} \right\}$$

If $Z_s = Z$

$$(3) \quad E_m = E_t - I_m \left\{ \frac{(1{,}000\,Z_o + 6ZL)\,2\,Z\,X - 9\,Z^2\,X^2}{1{,}000\,(1{,}000\,Z_o + 6\,Z\,L)} \right\}$$

or $$E_m = E_t - I_m \left\{ \frac{A\,X - B\,X^2}{C} \right\}$$

To find the value of X, for which the motor voltage (E_m) is a minimum, let the voltage drop vector = Y

Then $$\dot{Y} = \frac{A\,X - B\,X^2}{C}$$

Differentiate and equate to zero

$$\frac{dy}{dx} = \frac{1}{C^2}\,(CA - 2\,CBX) = 0$$

This is a maximum as

$$\frac{d^2y}{d\,X^2} = -\,2\,CB$$

Therefore $$(4) \quad X = \frac{A}{2B} = \frac{1{,}000\,Z_o}{9Z} + \frac{2}{3}\,L$$

This shows that the point of minimum voltage is beyond ⅔ of the distance from the line transformer and approaches that as a limit as the line becomes longer.

Auto-transformer capacity determined

To determine auto-transformer capacity necessary due to steady unbalanced load, assuming uniform unbalance along the line, let:

- L = Length of line.
- I_c = Auto-transformer load current.
- I_s = Unbalanced line current.
- i_s = Unbalanced line current per unit of length.
- x = Distance from line transformer to any point on line.
- dx = Increment of distance.

From diagram of current relations:

I_s = auto-transformer load current and $I_c = 2\,I_s$

In formula (1) substitute $i_s\,dx$ for I_m,

A for $\left(\frac{Z + 2\,Z_s}{1{,}000\,Z_o + 2\,Z\,L + 4\,Z_s\,L} \right)$ and $\frac{dI_s}{2}$ for I_s

Then: $$dI_s = 2\,A\,i_s\,x\,dx$$

Integrating: $$I_s = 2\,A\,i_s \int x\,dx$$

$$I_s = 2\,A\,i_s \left[\frac{x^2}{2} \right]_0^L$$

Therefore: $$I_s = A\,i_s\,L^2$$

As: $i_s\,L = I_s$ $\qquad$ $I_c = A\,I_s\,L$

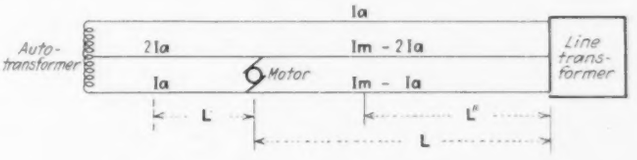
Substituting for A

$$(5) \quad I_c = \left(\frac{Z + 2\,Z_s}{1{,}000\,Z_o + 2\,Z\,L + 4\,Z_s\,L} \right) I_s\,L$$

For a 1,000-ft. line

$$I_c = \left(\frac{Z + 2\,Z_s}{Z_o + 2Z + 4\,Z_s} \right) I_s$$

Explanation of the method used to derive curves, for line with auto-transformer, in Figure (2) from curves of Figure (1) follows next:



In the above diagram current values are those developed in deriving formulas (2) and (3) and:

- L = distance from line transformer to motor.
- L′ = distance from motor to service between motor and auto-transformer.
- L″ = distance from line transformer to service between motor and line transformer.
- d′ = voltage drop per unit of neutral conductor length per ampere.
- d = voltage drop per unit of other conductor length per ampere. (As the power factor of these currents is approximately the same, d may be assumed constant without appreciable error.)
- I_m = motor current.
- D = voltage drop at motor under starting conditions.
- D′ = difference in voltage drop between points distant L and L + L′ from line transformer.
- D″ = voltage drop at point distant L″ from line transformer.
- D_m = voltage drop from line transformer to motor at 120 volts (no auto-transformer).

First: To find voltage at any point between motor and auto-transformer:

$$D = \left[(I_m - I_s)\,d + (I_m - 2\,I_s)\,d' \right] L$$

Solving for I_s

$$I_s = \frac{L\,(I_m d + I_m d') - D}{L\,(d + 2d')}$$

$$D' = (I_s d + 2\,I_s d)\,L'$$

Substituting for I_s

$$D' = L'\,(d + 2\,d') \left\{ \frac{L\,(I_m d + I_m d') - D}{L\,(d + 2d')} \right\}$$

$$= \frac{L'}{L} \left\{ L\,(I_m d + I_m d') - D \right\}$$

Where: $$L\,(I_m d + I_m d') = D_m$$

Then: $$D' = \frac{L'}{L}\,(D_m - D)$$

Second: To find voltage at any point between motor and line transformer:

$$D'' = \left(\frac{L''}{L} \right) D$$

South and West Join in Rise

As in other parts of the country, industrial activity in the South and West was much greater in February this year than last and, after adjustment for the number of working days, shows considerable gains over January. Based on electrical energy consumption in a large number of establishments in various lines of manufacturing, as reported to ELECTRICAL WORLD, the weighted average in the South was 20 per cent higher than in February of 1933, and in the West 28 per cent higher. Prominent in the Southern states is the 65 per cent rise over last year in the iron and steel industry, continuing on its recent higher level. Chemicals rose 30 per cent, textiles 12 and lumber, though still low compared with earlier years, gained 29 per cent.

In the West the year's increase in the metals group rose to 77 per cent, though activity in this group is even now relatively low. The index for rubber products more than doubled, the stone, clay and glass group rose 51 per cent and other considerable gains appear in the table.

Advances over January were general. Several revisions from the figures previously announced for that month, most of them upward, were made necessary by belated returns.

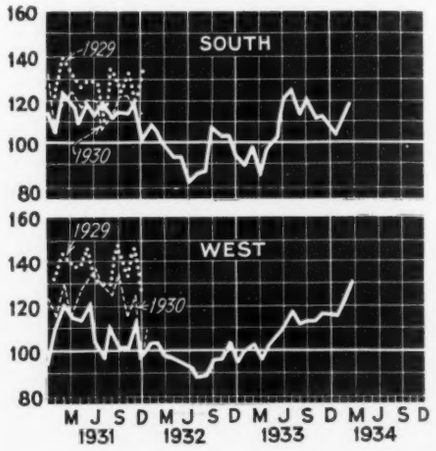
Index of monthly manufacturing activity, South and West

Base: Average month 1923-1925 = 100

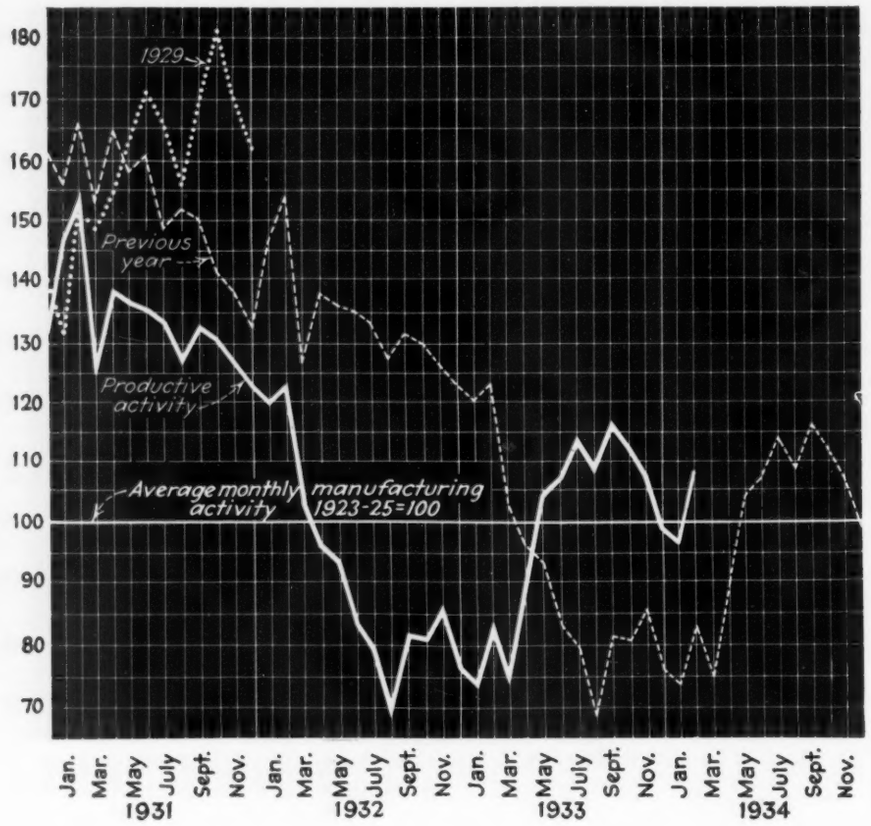
(Corrected for number of working days, but not for seasonal variation)

	South					West				
Industrial groups	Feb., 1934	Jan., 1934	Dec., 1933	Nov., 1933	Feb., 1933	Feb., 1934	Jan., 1934	Dec., 1933	Nov., 1933	Feb., 1933
All Industry	**119.3**	**103.9***	**107.5**	**113.3**	**99.3**	**130.0**	**118.2***	**115.3**	**116.9**	**102.0**
Chemicals	175.8	157.4*	182.0	166.1	135.2	100.5	93.0*	92.7	86.0	79.8
Food products	145.7	134.0*	127.8	153.6	131.5	133.3	121.0*	116.3	118.9	118.2
Iron and steel	136.8	135.1	140.6	110.8	82.7	....	....	....	....	....
Metal working	97.5	85.4	93.8	82.5	85.7	....	....	....	....	....
Metals group	119.3	113.2	120.0	98.8	84.0	79.5	71.0*	77.5	76.3	44.8
Lumber	48.6	39.4	40.8	46.3	37.6	181.0	165.4*	156.7	162.8	144.8
Paper and pulp	164.4	152.2	164.0	173.8	151.5	161.0	145.6	129.4	135.0	127.0
Rubber products	118.0	106.8*	77.0	69.5	109.3	117.0	96.8*	84.0	97.5	46.8
Shipbuilding	....	....	....	....	....	146.0	126.8	118.0	123.0	122.3
Stone, clay and glass	120.7	100.4*	85.4	109.0	101.8	126.2	117.5	122.3	120.0	83.7
Textiles	134.0	108.0*	108.8	123.1	119.3	....	....	....	....	....

*Revision



Electrical Works Use More Energy



Operations in electrical manufacturing establishments during February were 30 per cent more active than in the like month a year ago, according to the amount of electrical energy reported to the ELECTRICAL WORLD as having been used by them. Moreover, the returns show an increase of 11 per cent over January, after taking account of the difference in the number of working days. The adjusted index numbers regularly show such an increase in February, probably due to delayed readings whereby that month's energy use is exaggerated, but the present increase is greater than usual.

The rate of increase of the conspicuously large concerns did not differ greatly from the average of the smaller ones, though with a slight advantage in favor of the former.

Monthly Index of Electrical Manufacturing Activity

Adjusted to 26 working days

Base: Average Month, 1923-1925

	1931	1932	1933	1934
January	146.6	120.0	74.0	97.1
February	154.3	122.2	83.3	108.2
March	126.1	102.9	75.0	....
April	138.1	95.6	89.4	....
May	136.7	92.8	104.1	....
June	135.2	83.1	106.9	....
July	133.4	79.2	114.0	....
August	126.9	67.6	108.4	....
September	132.6	81.4	115.2	....
October	130.4	80.9	111.7	....
November	126.9	85.6	107.0	....
December	123.5	76.0	99.4	....

February Industry 29 per Cent Over 1933

ELECTRICAL energy consumption during February in manufacturing plants canvassed each month by ELECTRICAL WORLD shows an increase of 29 per cent in the rate of activity compared with the same month in 1933. Since the similar increase in January was only 23 per cent and in December 21 per cent, the returns give evidence of an increasing margin over operations a year ago.

February usually shows a rise over January, which may perhaps be ascribed partly to a slight delay in reading meters at the end of the short month, thereby adding a day or two in some plants to the energy reported, at the expense of March, but the present increase of 15 per cent over January is abnormally large, and therefore also points to accelerated operations.

The year-to-year gain was particularly striking in the automobile industry, where it amounted to 56 per cent. Rubber products manufacture was carried along, with 55 per cent gain. Close behind is metal working, 51 per cent. Registering the increased demand for steel, that industry's index is 37 per cent higher than it was a year ago, and the stone group is up 34 per cent.

It will be noted that these are the industries primarily indicative of increased purchasing power and of activity in construction. However, such distinctly consumer-goods industries as leather products and textiles are also much above last year's level, the former by 26 and the latter by 27 per cent. Even foods, paper and pulp, and chemicals show material gains, though consumption of those commodities fluctuates less widely in response to varying economic conditions.

Comparison with the index numbers for January indicates gains in every field, after adjustment for differences in the number of working days. Regional figures are given in part in the accompanying table, and for the South and West on another page of this issue.

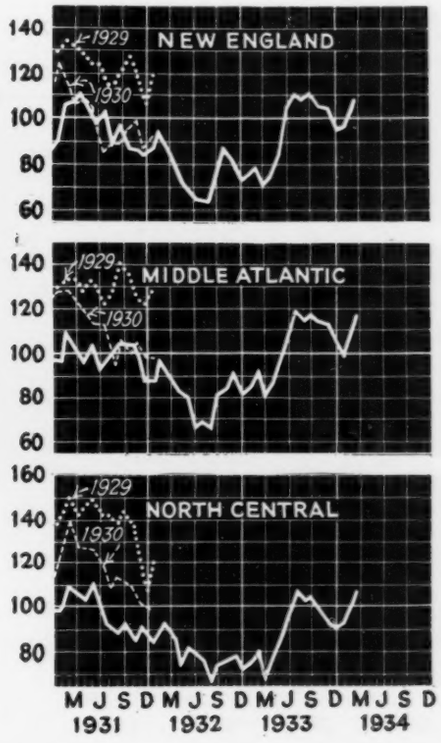
Some of the revised figures for January are higher than those originally published, due to late returns, especially in automobiles. The chief decrease was in North Central textiles.

Index of monthly manufacturing activity

Base: Average month 1923-1925 = 100

(Corrected for number of working days, but not for seasonal variation)

These data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,800 large manufacturing plants in various industries and scattered throughout the country.



Industrial Groups	United States Feb., 1934	United States Jan., 1934	United States Dec., 1933	United States Feb., 1933	New England Feb., 1934	New England Jan., 1934	New England Dec., 1933	New England Feb., 1933	Middle Atlantic Feb., 1934	Middle Atlantic Jan., 1934	Middle Atlantic Dec., 1933	Middle Atlantic Feb., 1933	North Central Feb., 1934	North Central Jan., 1934	North Central Dec., 1933	North Central Feb., 1933
All industry	**111.8**	**97.4***	**96.0***	**86.5***	**109.7**	**97.8***	**95.3**	**79.8**	**116.8**	**101.8***	**104.3**	**91.8**	**107.0**	**95.5***	**91.3***	**80.5**
Automobile (incl. parts and accessories)	95.5	74.9*	61.4*	61.2	....	....	....	....	81.8	72.2*	66.8	63.7	96.2	79.0*	61.9*	60.2
Chemical products (incl. oil refining)	164.0	147.5*	162.1	130.0	172.0	149.4*	166.9	138.8	175.7	157.0*	168.0	138.0	145.1	129.2*	130.5	120.7
Food products	120.1	106.0	107.3	112.5	....	....	....	....	129.0	114.3*	111.0	111.1	112.0	98.2*	102.4	108.3
Iron and steel	87.6	76.2*	75.7	64.2	114.3	115.3*	129.6	83.8	83.1	71.5*	69.0	47.5	87.2	75.7	76.2	73.7
Metal working	88.6	78.7*	77.5	58.4	121.1	107.2	105.8	75.7	71.3	64.3	66.2	54.1	100.2	87.8*	82.2	56.5
Metals group	88.3	77.8*	77.0	60.6	119.0	109.4*	112.7	78.2	76.4	67.4*	67.4	51.3	90.7	83.3*	80.0	60.1
Leather products	119.2	89.7*	85.5	95.0	107.4	72.5*	62.8	88.2	154.7	109.2*	104.9	107.1	94.5	85.7*	86.8	88.2
Forest products	113.2	102.9*	97.8	91.0	49.7	46.8*	49.3	51.8	68.3	60.8	63.7	57.5	93.7	86.2*	84.0	77.1
Paper and pulp	129.1	119.8*	120.0	111.0	131.7	128.0	127.0	103.5	109.6	98.4*	98.0	89.9	116.4	110.5	107.3	110.8
Rubber products	141.3	128.6*	108.2	91.0	113.7	113.5*	100.6	91.7	....	....	....	....	146.2	132.5*	108.5	88.0
Shipbuilding	107.6	91.0	89.3	89.2	....	....	....	....	....	....	....	....	....	....	....	....
Stone, clay and glass	90.3	74.3	72.2	67.2	....	....	....	....	58.5	41.8	46.2	48.4	121.5	105.0	91.0	82.5
Textiles	117.0	99.5	94.6	92.5*	89.4	79.2*	69.3	63.7	151.6	132.5*	131.7	123.0	162.5	132.5*	147.0	120.9

*Revision.

Better Veneer from Poorer Logs —Electrically

By B. A. OLSON
Superintendent Oregon-Washington Plywood Company
and K. L. HOWE
Engineer, Seattle Office,
Westinghouse Electric & Manufacturing Company

Waste in veneer production can be cut 95 per cent by co-ordinated automatic regulation of the speeds of the lathe and off-bearing table; no time need be wasted in removing split veneer; operators can concentrate on operating technique and get more uniform product.

Thus waste is reduced to that inevitably occurring due to irregular surface condition of log on which cutting has just started. Production and quality both improve. Profits increase.

PRESENT-DAY wood veneer plants offer many opportunities for improvements in economy and efficiency. This paper describes a logical method for speed adjustment of the veneer lathe as well as automatic speed control of the off-bearing table. Production may be increased, 95 per cent of all breakage eliminated, and a more uniform quality of product obtained with better conversion of raw materials. Improvements in plant operation are necessary in order to retain all advantages which an industry may acquire, and to this end automatic speed control of the off-bearing table of the veneer lathe has been developed and applied.

The veneer lathe with its accessory equipment is the principal operation in the veneer plant. The general arrangement of veneer lathe, off-bearing table, motor-generator set and operator's control stand is that of Fig. 1. A log placed in the lathe is rotated against a knife which is advanced toward the center of the log at a predetermined rate for each turn of the log, and the uniform layer of wood veneer thus cut from the surface of the log is carried away by the off-bearing table. The table is about 100 ft. long, arranged with five or six decks, all of which can be individually started or stopped by either of two operators, one stationed at the off-going or cut-up end of the table and the other at the on-going or lathe end. An operator at the lathe end of the table guides the veneer coming from the lathe onto the desired deck of the table, while the lathe operator controls the motion and speed of the lathe.

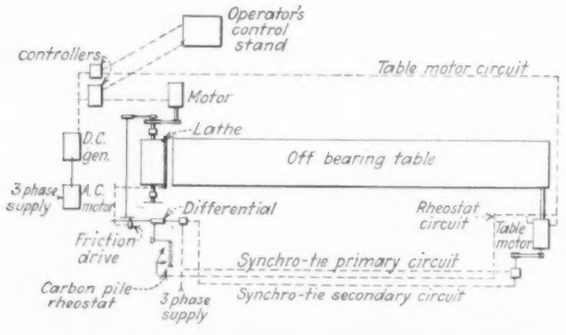


Fig. 1—Veneer lathe and off-bearing table are driven automatically at speed increasing with decrease in diameter of log being turned in veneer lathe

Elements of the control comprise shunt-motor field rheostat for lathe motor, carbon-pile compression rheostat for table motor, synchro-tie, differential and friction speed proportioner. Electrical circuits here are single-line convention.

In the past the lathe operator has had the additional duty of regulating the speed of the off-bearing table. Proper operation of the lathe demands constant attention, but the speed of the off-bearing table must always be adjusted to the rate of production of veneer. If the table is too slow the veneer slacks and breaks rapidly in passing from the lathe to the table, and if the table is too fast the veneer is pulled apart. A break or split in a sheet of veneer 8 ft. wide means an average loss of 2 ft. of lineal length, since the spiral or twist in the grain of the veneer log produces a diagonal break.

The lathe must be operated with care in starting a cut on the irregular surface of a log; knots and pitch pockets demand caution in operation and, also, speed must be reduced at the very core of the log. In view of all these duties the lathe operator cannot readily maintain correct speed on the off-bearing table.

Ideal application for adjustable-speed d.c. motors

The lineal rate in feet per minute at which veneer is produced is essentially constant. Each veneer lathe has definite limits of maximum and minimum diameter of cut. A lathe set to cut veneer of a given thickness requires constant force at the knife. Maximum log diameter demands maximum torque and minimum revolutions per minute of the lathe. As the veneer log is reduced to minimum diameter, maximum speed at minimum torque is approached. Therefore the characteristics of an adjustable-speed direct-current motor are well suited to the veneer lathe, which is an ideal constant horsepower application. Veneer lathes in the past have been driven from line shafts, steam engines and in later years wound-rotor induction motors. Many wound-rotor motor applications are made, but the adjustable-speed direct-current motor is the real answer to demands for efficiency and flexibility.

A direct-current motor-driven veneer lathe may receive power from a d.c. power system, but more often it is necessary to provide an a.c.-d.c. motor-generator set.

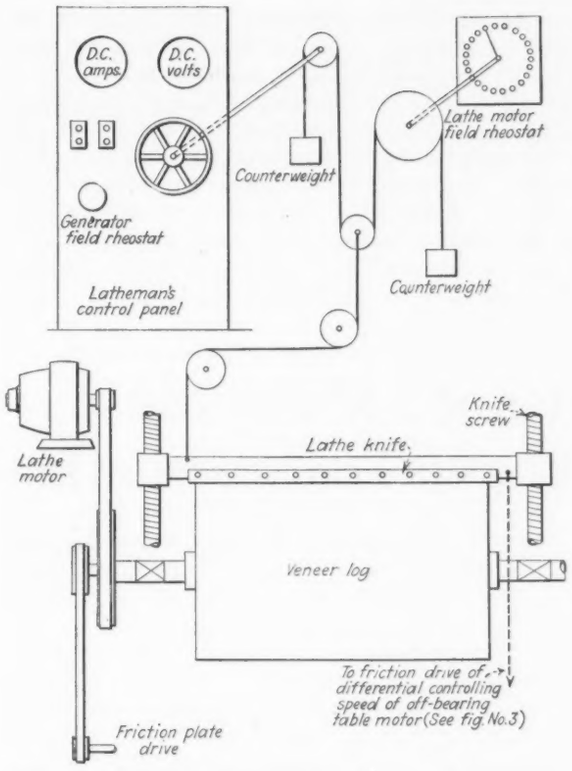


Fig. 2—Veneer knife travel adjusts lathe motor field rheostat for increased speed

Counterweight and pulley system gives operator control of speed up to point of uniform veneer sheet production, whence it becomes automatic. Connection to friction plate drive and differential explained in Fig. 3.

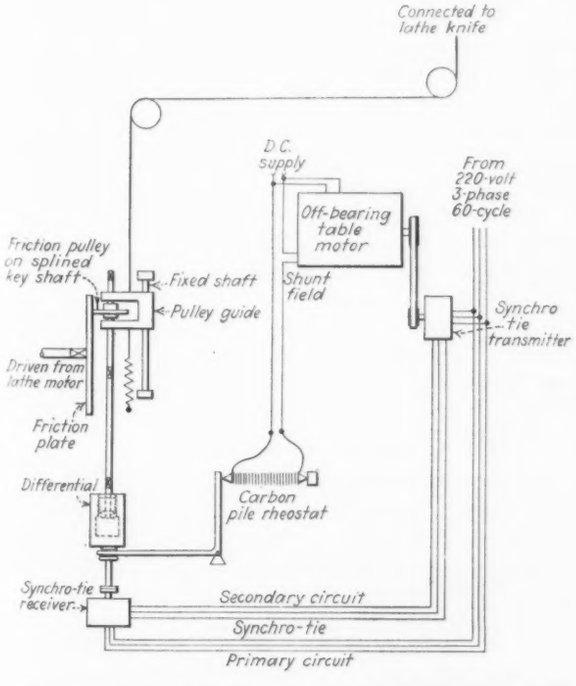


Fig. 3—Any difference in speed between lathe and table is corrected by carbon-pile field rheostat actuated by synchro-tie, differential and friction drive

Magnetic control for the lathe motor and the table motor, push-button operated, is the most desirable combination.

Speed control of the lathe is accomplished by the shunt field rheostat mounted in the lathe operator's control cabinet, and as soon as a uniform surface condition is established on the veneer log there is no reason why the lathe speed cannot be automatically increased as the log diameter is reduced. An arrangement of sprockets, chains and idler sheaves with the end of one cable fastened to the veneer lathe knife for this purpose is shown in Fig. 2. Movement of the knife corresponds to a change in log diameter and by a proper mechanical ratio the field rheostat controlling motor speed is shifted from one limit to the other for a complete movement of the knife. Further, the latheman has supervision over the cutting speed at all times, since he can at any time increase or decrease the speed by adjustment of the manually operated sprocket. However, the speed is automatically increased from any log diameter for a given setting established by the operator. Thus the latheman is relieved of the continuous duty of speed adjustment of the lathe. Speed increase is necessary as the log diameter is reduced in order to produce veneer at a constant rate. The control cabinet, located conveniently to the latheman, also contains the mechanical system shown in Fig. No. 2, push buttons for the lathe motor and table motor magnetic control, as well as generator voltmeter, field rheostat and ammeter.

Differential and carbon pile for table

Having established an automatic and uniform rate of cutting veneer, improvements in control of the off-bearing table were also desirable. An adjustable-speed direct-current motor drives all decks of the table as selected by the operators. Automatic speed control of the table motor can be accomplished by a carbon-pile rheostat in the motor-shunt field. The rheostat is actuated by a mechanical differential, the primary element of which is driven by the lathe motor and the secondary element by the off-bearing table motor. Since the differential controls the rheostat, which in turn governs the table motor, and the table motor determines the rate of rotation of the secondary element of the differential, the reference speed must come from the primary element of the differential. In other words, the speed condition of the table motor is always matched to suit the reference speed established by the primary element. Referring to Fig. 3, it may be noted that the table motor drives the secondary element of the differential at a definite rate of rotation for a given moor speed, either by direct coupling, using a long shaft, or by means of a synchro-tie, which consists of two wound-rotor motors with their rotor circuits connected together and their stators energized from the same source of three-phase power.

The differential device consists of a screw and nut, the screw being the primary element driven from the lathe; the nut is the secondary element driven from the table motor. When the table motor speed does not match the speed of the primary element the nut on the differential device does not run at the same speed as the screw and the difference in rate of rotation causes the nut to travel on the screw. A groove in the periphery of the nut receives the fork end of a lever, which governs compression on the carbon-pile rheostat. Thus a difference in rate of rotation between the screw and nut causes the nut to travel along the screw and move the

lever, which changes the compression on the carbon-pile rheostat. Since the rheostat is in the shunt-field circuit of the off-bearing table motor any speed condition of the table which does not correspond to the reference condition established by the primary element of the differential device will cause an adjustment of the compression of the carbon pile, which will in turn change the speed of the table motor.

Lathe knife position regulates table speed

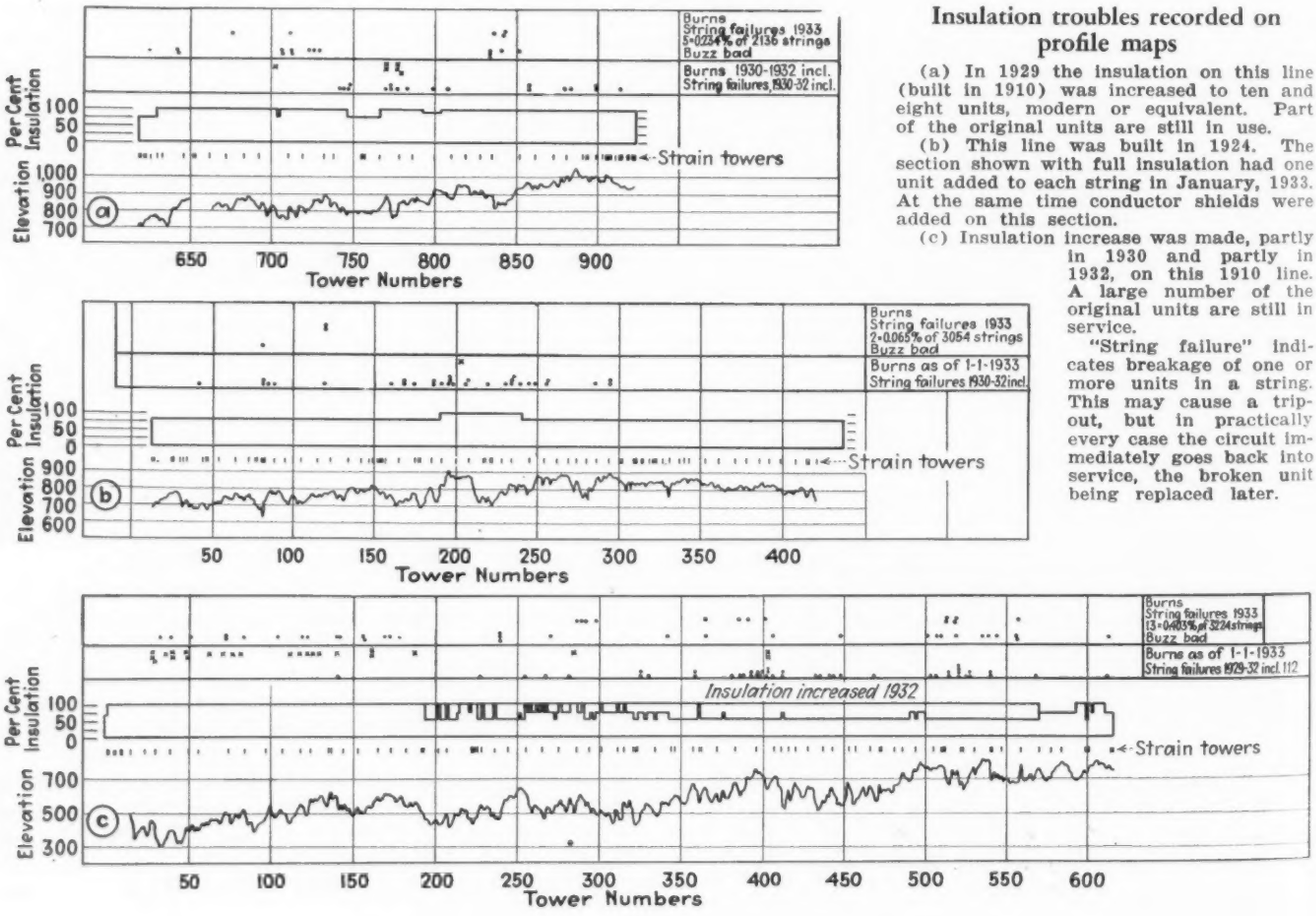
As yet no account has been taken of the effect of a constantly changing diameter of the log in the lathe. Speed control of the table motor can only be accomplished through the carbon-pile rheostat and the differential device, therefore a speed-changing device must be used between the lathe and the primary element of the differential. Referring to Fig. 3, the lathe motor drives a friction plate at a fixed ratio; that is, the speed of the friction plate is always proportional to the lathe speed. The friction plate drives a friction pulley, which is retained in a certain position, on a splined key shaft, by means of a guide. The position of the guide is determined by a cable connection to the lathe knife acting against a reaction spring. Since the position of the lathe knife is a direct indication of log diameter, the arrangement will produce a speed on the friction pulley, and therefore on the primary element of the differential, that is proportional to log diameter. It is therefore evident that for a fixed lathe speed the friction plate and pulley will produce an off-bearing table speed always proportional to log diameter.

It was previously determined that the drive for the primary element of the differential, being taken from the lathe motor, would produce an off-bearing table speed proportional to the lathe speed. All that now remains is to choose the proper ratio of belted and geared connections for matching the peripheral speed of the veneer log exactly with the speed of the conveyor belts on the decks of the off-bearing table and conditions will be complete for maintaining a speed on the off-bearing table which will match the speed at which veneer is produced regardless of log diameter or speed of the lathe.

Planned Maintenance Protects Transmission Lines

Record system used by Duke Power Company to improve line insulation and performance. Data correlated with locations and use of profile maps.

Many utility systems take and use data on their transmission lines so that performance may be improved and service continuity insured. One interesting method is used on the system of the Duke Power Company. This system operates slightly more than 1,000,000 kva. in generating capacity with 2,114 circuit-miles of 110-kv. transmission and approximately the same amount of 44-kv. transmission.



Insulation troubles recorded on profile maps

(a) In 1929 the insulation on this line (built in 1910) was increased to ten and eight units, modern or equivalent. Part of the original units are still in use.

(b) This line was built in 1924. The section shown with full insulation had one unit added to each string in January, 1933. At the same time conductor shields were added on this section.

(c) Insulation increase was made, partly in 1930 and partly in 1932, on this 1910 line. A large number of the original units are still in service.

"String failure" indicates breakage of one or more units in a string. This may cause a trip-out, but in practically every case the circuit immediately goes back into service, the broken unit being replaced later.

The maintenance method is premised upon a buzz test of the 916,000 insulators and an inspection of conductors, clamps and shields once each year as well as a record of replacements and repairs during the year. The data are taken with positive identification of conductor, tower, conductor position on tower, insulator string and insulator disk. Usually before the summer storm period insulator buzz tests are made on all lines and at this time those that test bad are replaced. These data, as well as data on replacements and repairs made during the year, are summarized and are then broken down and correlated for each line to ascertain causes of trouble and to use as determining data for line improvements. The cause of the trouble, the date of the trouble, the tower number, the type and make of insulator, the position in the insulator string and on the arm—all this information is tabulated for each line.

Troubles identified and corrected

Data for each year are then tabulated with data obtained in previous years to show conditions over a period. With this record of storms, failures and location of failures or troubles, a positive guide is given for improving conditions. At the time the buzz tests are made inspection is made for burns, blisters or injuries on shields or conductors from flashovers and this record is tied into the insulator record. At each inspection these scars or burns are painted so that only new indications appear each year.

On a system built up over a period of years with different types and vintages of insulators, construction and conductors, the total data show very accurately good and bad lines based upon performance. They also show that troubles are largely localized on certain definite parts of each bad line and indicate the path of prevalent storms or other influences. They also show a certain relationship between failures and inches of rainfall, probably because of the effect on ground conditions.

On the Duke Power 110-kv. system for the 566,000 modern insulators the annual replacement of insulators from all causes is quite consistent each year at 1/20th of 1 per cent, and measured by insulator records alone it is doubtful if insulator data of this detailed type are warranted. But these data are essential to improve line performance. They indicate the magnitude and fix the location of troubles on all lines and thus permit definite steps to be taken to raise the standard of performance. On recently built modern lines the replacements are so few and service so good that nothing needs to be done, but these data serve as a check and catch incipient troubles. On some of the older lines, however, the data indicate where and how much to improve the insulation.

Service dictates insulation

Typical profile maps of this type of line are shown in accompanying illustrations. It will be noted that the troubles are quite definitely grouped as to location and the first definite step is to improve the insulation. The graphs are plotted to show successive changes in insulation and the results obtained as the insulation is raised toward the 100 per cent level. This value for 110-kv. lines is ten strain and eight suspension units, but several lines give fine performance with less insulation, so it is not advisable or economical to put this insulation value on the lines until the service data show it to be necessary and advisable.

Records of this character have been kept by the Duke Power Company over many years and the results obtained by applying those actual performance data to line performance improvement are very evident on the performance records of successive years.

[Informal opinions on present conditions and problems confronting the industry are helpful. We welcome to this forum the type of discussion presented by Mr. Dean and hope others will discuss industry questions in a similar constructive vein—EDITORS.]

S. M. Dean suggests—

Chief Assistant Superintendent
Electrical System
Detroit Edison Company

An operating approach to system investment studies based on intercompany records

Improved business conditions are here and with them comes a renewed interest in the planning of system extensions. Because the watchword in every industry is "economy," we also must be prepared to give good and acceptable electric service at lower system costs than ever before. More specifically, that means that for the bulk power system, the subtransmission lines and the distribution substations we must in every case face and answer the question, "How can I provide the required number of kilowatts of firm capacity at the lowest cost consistent with system plans and the probable rate of growth?" To define "firm capacity" one must first determine for each situation the minimum of reserve equipment required to insure reliable service and then deduct that from the available facilities to set the firm capacity. Reliability reserves can be intelligently determined only from actual performance of the particular system in question.

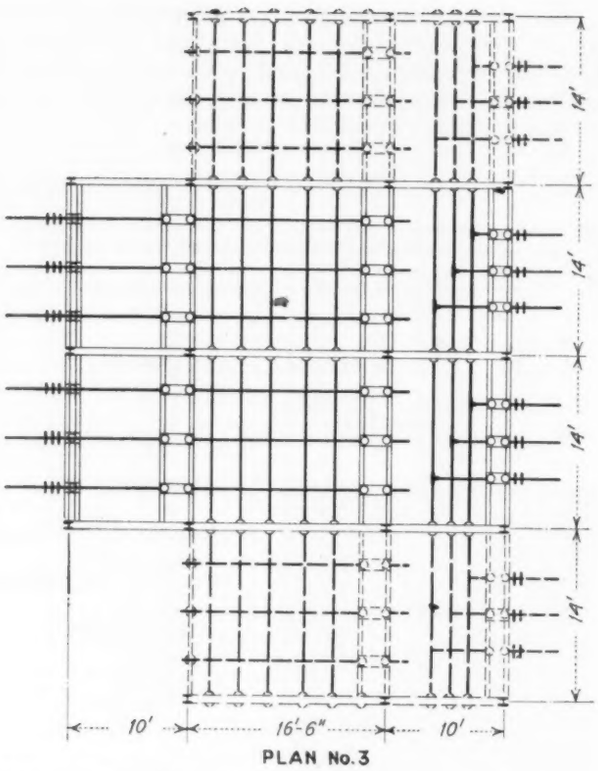
In the distribution system, on the other hand, it is usually impracticable to set firm capacities. The inevitable question, therefore, becomes, "How can I provide sufficiently reliable service at a minimum of cost?" Again, what constitutes "sufficiently reliable service" turns entirely upon the actual performance of the distribution system in question.

Therefore, one of the immediately important tasks is that of accumulating a background of actual operating performance records. These records should be as far as possible on a uniform basis so comparisons may be made between companies. Such records will not only serve as a basis for establishing firm capacities within any property, but will also enable the engineer to "orient" himself by comparing his methods with those employed by others.

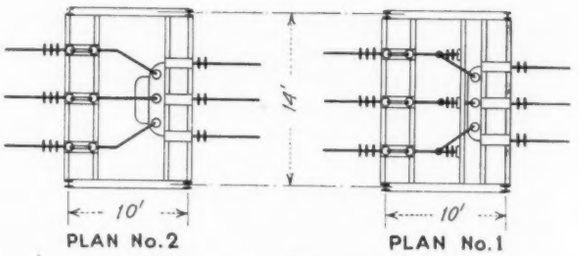
This is a matter of first rate importance to every executive engineer.

Flexible Substation

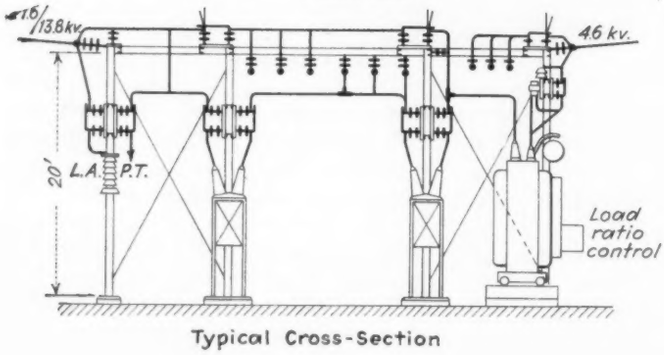
By adopting a standardized design for its outdoor substations this New England utility has opened the way to a flexibility which meets community growth without the penalties of more rigid specifications.



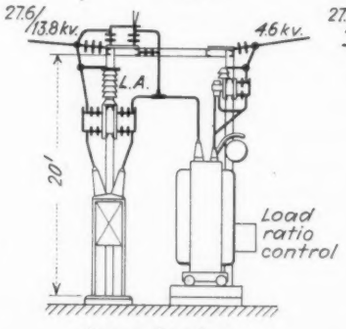
PLAN No. 3



PLAN No. 2 PLAN No. 1



Typical Cross-Section



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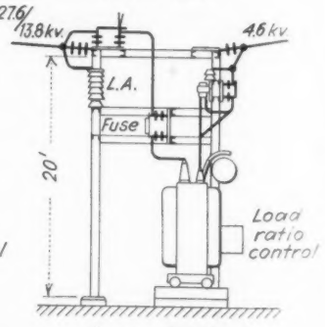

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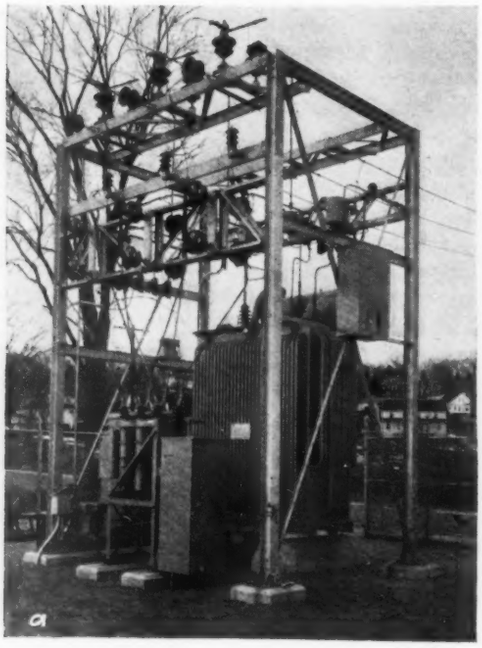
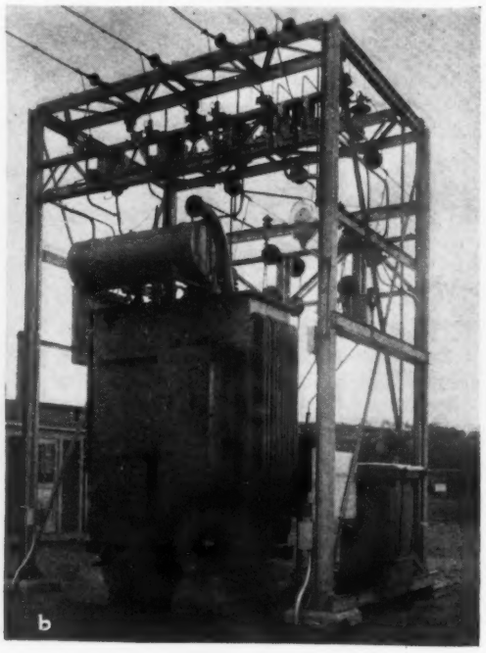




Substation grows by duplication and lateral extension

Plan 1—Simplest form for a 1,000-kva. station. Three-shot repeater fuses are used to protect both transformer and distribution circuits.

Plan 2 is Plan 1 modified for use of automatic reclosing oil circuit breakers in place of fuses.

Plan 3 — Elementary layout readily expanded. By building in both longitudinal and lateral directions the station can be enlarged without alteration of the original unit and thus provide for (a) duplicate supply lines, (b) additional transformer and distribution circuits, (c) emergency throw-over for distribution circuits for servicing or repairing any transformer.

Watertown substation typifies the standard design

(a) The high side and (b) the low side with an outdoor series street lighting transformer operated by time switch.

Meets Growth

By CALVIN T. HUGHES

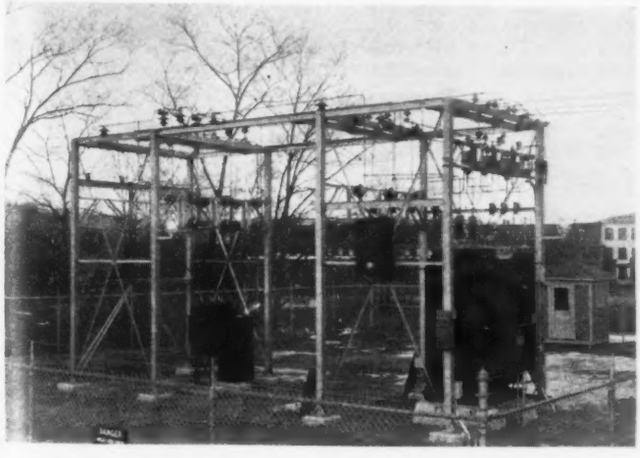
General Engineer Connecticut Light & Power Company, Waterbury

THERE usually comes a time when the increases in substation load can no longer be met with existing facilities because of excessive energy loss and poor voltage regulation. Normal growth in residential, small power and commercial loads make this a continually recurring problem in the outlying communities. When buildings were provided to house the substation equipment the problem was more acute than it is now with outdoor equipment available and since the advent of tap-changing under load in replacement of the induction feeder regulator with its low-tension switching. But with these advances as a foundation the Connecticut Light & Power Company has adopted a standardized design of outdoor substation which completely solves the problem of meeting growth. Annual costs for the new design average about 60 per cent of those entailed by the old layout.

Initially a 2.3, 4 or 4.6-kv. substation fed by a supply line in the 13.8 to 27.6-kv. class will usually have to have from 500 to 1,500 kva. capacity. It will have one or two outgoing distribution circuits. Load estimates of future growth may, however, indicate that two or four circuits may later be necessary along with 2,000 to 5,000 kva. of capacity. If the conventional method is followed, in addition to the necessary transformers, there will be provided buses and switching at the supply voltage and buses, switching and feeder voltage regulators at distribution voltage, with building to house all or part of the equipment. In the initial installation of such a layout the building, if space is provided for future growth, looms large as an item of cost, both fixed and annual.

Taking full advantage of the new outdoor facilities and the load-ratio tap-changing, there have been several new substations built on the Connecticut Light & Power system which afford high flexibility in meeting growing demands as to both kva. and number of circuits. How this is accomplished is best seen from the illustrations where the features are detailed and discussed. The transformers generally used are 1,000 or 1,500 kva., three-phase, with load ratio control on the 4,600-volt side having taps arranged for 15 per cent boost and 5 per cent buck in the eight 2½ per cent steps. With this arrangement of taps the effective range of voltage regulation is increased by 5 per cent when compared with the usual practice of separate transformer and feeder regulator, assuming equivalent core losses for the transformers.

A portable 1,000-kva., three-phase transformer is maintained as a spare for use in emergencies at any of the twelve substations which have been built along these principles.



Waterville substation has one of the bays of Plan 3

Electrically Set Fires Small Part of Nation's Loss

Electrical causes account for a relatively small fraction of the annual fire losses in the United States. According to a compilation by the actuarial bureau of the National Board of Fire Underwriters, just published in "Safeguarding America Against Fire," the total recorded losses due to all causes in 1932 amounted to $320,687,643. It is customary to add 25 per cent to cover losses not reported to the actuarial bureau, so that the estimated total was about $400,000,000.

Of the reported loss $11,883,154, or 3.70 per cent, was attributed to electrical causes. Despite the universality of its use electricity is one of the smaller factors in running up our large national fire bill. Aside from the losses of more than $152,000,000 of which the causes could not be determined, it is greatly exceeded by a number of other known causes, giving rise to losses (expressed in millions of dollars) as follows: Exposure (including conflagration), 26; matches and smoking, 24; defective chimneys and flues, 20; incendiarism, 18; stoves and furnaces, 14.

Electrical fires are ascribed to sub-standard installations, fixtures and appliances and carelessness in the use of current and appliances. Results of efforts toward greater safety are seen in the reduction of $1,784,032 in such losses from 1931 to 1932.

Keeping Tabs on Factory Circuits

In a Boston factory gradually being changed from direct to alternating current distribution local lighting feeders operated on direct-current supply are controlled by black-handled switches at the main board. As each feeder is transferred to the other service, the connections between the switch studs at the rear of the board and the adjacent 115-volt direct-current buses are removed and short jumpers run from the studs to a newly installed alternating-current bus, leaving the fuses at all times on the load side of the feeder. Each transferred feeder switch handle is then painted red, and when all lighting circuits have been changed the black handles will be restored and the direct-current buses removed. This identification is a convenience to the maintenance department, which performs the reconstruction work during lulls in repair jobs.

Census Figures Throw Light on the Rate Problem

When the character of the load of municipal and private utilities is analyzed the effect upon rate structures is evident.

With a high percentage of domestic consumers and proportional use, but with relatively fewer farms, industrials and railroads as customers the municipals fail to share the electric service burden and show it in their rate structures.

MUCH light is thrown by recent Census data on the relative status of the privately owned and municipally owned electric utilities as to outputs to different classes of customers, consumptions per customer and average rates for the respective groups. The figures also contribute considerably to the discussion "Lower rates may mean merely more kilowatt-hours for less dollars." Some newspaper commentators have already interpreted the data as excuse for raising the question "What is all the shooting about on rates?" In some categories the municipals as a group are collecting more per kilowatt-hour than the commercial companies. In fact, this is true of their average rate per kilowatt-hour for all services. On the other hand, the municipals have lower rates as a national average in some categories than the private companies. Analysis of the data, reconciled with the fundamentally different policies that have actuated the two groups of enterprises, shows that the results are not at all strange or startling. As always, figures lie enmeshed in environment which they do not carry along with them when they march in rows and columns.

As seen from the table reproduced again here (as soon as issued by the bureau it appeared in the news pages of the December 16 issue of ELECTRICAL WORLD), it is evident that in *proportion to their respective total kilowatt-hour sales* the municipal systems carry only 18 per cent as much farm load, only 23.3 per cent as much large light and power load and only 17.1 per cent as much street railway and interurban loads as the privately owned utilities. What they carry against the commercial utilities' 762,115,347 kw.-hr. of electrified steam railroad load is only 89,516 kw.-hr., a wholly negligible proportion. When, however, it comes to other categories the figures are reversed. Thus the municipals have domestic output 2.22 times as great, small light and power 1.94 times as great and street lighting 4.23 times as great proportionally as the commercial systems. It is inevitable that these wide differences in character of service should be reflected in some differences in rate policy and in rate magnitude, entirely apart from any injected differences in philosophy or social objectives.

Number of Customers, Current Sold and Revenue from Electric Service (Ultimate Consumers Only) by Class of Service, Commercial and Municipal Establishments: 1932

	Number of Customers			Current Sold, Kilowatt-Hours			Revenue from Electric Service, Dollars		
Class of Service	Total	Commercial	Municipal	Total	Commercial	Municipal	Total	Commercial	Municipal
Sales to ultimate consumer, total	23,858,411	21,630,662	2,227,749	65,895,975,835	62,147,695,152	3,748,280,683	1,821,105,524	1,703,303,728	117,801,796
Farm service	613,753	592,692	21,061	1,504,257,106	1,488,105,684	16,151,422	42,773,826	41,874,996	898,830
Domestic service	19,285,560	17,337,876	1,947,684	11,790,139,511	10,410,749,374	1,379,390,137	649,764,750	584,995,286	64,769,464
Commercial service:									
Small light and power (retail)	3,527,794	3,284,326	243,468	12,059,463,977	10,793,767,814	1,265,696,163	491,852,492	459,440,913	32,411,579
Large light and power (wholesale)	379,402	365,038	14,364	32,380,076,220	31,931,212,851	448,863,369	483,390,649	475,738,880	7,651,769
Municipal street lighting	29,832	28,997	835	2,235,668,364	1,746,288,517	489,379,847	92,010,645	81,795,213	10,215,432
Railroads (motive power):									
Street and interurban	474	454	20	4,392,943,247	4,384,207,607	44,735,640	38,777,175	38,296,902	480,273
Electrified steam-railroad divisions	367	363	4	762,204,863	762,115,347	89,516	7,018,519	7,015,342	3,177
Other service	21,229	20,916	313	771,222,547	667,247,958	103,974,589	15,517,468	14,146,196	1,371,272

	Current Sold per Customer (Kilowatt-Hours)			Revenue from Electric Service, per Customer (Dollars)			Revenue per Kilowatt-Hour (Cents)		
Class of Service	Total	Commercial	Municipal	Total	Commercial	Municipal	Total	Commercial	Municipal
Sales to ultimate consumer, total	2,762	2,873	1,683	76	79	53	2.8	2.7	3.1
Farm service	2,451	2,511	767	70	71	43	2.8	2.8	5.6
Domestic service	611	600	708	34	34	33	5.5	5.6	4.7
Commercial service:									
Small light and power (retail)	3,418	3,286	5,199	139	140	133	4.1	4.3	2.6
Large light and power (wholesale)	85,345	87,474	31,249	1,274	1,303	532	1.5	1.5	1.7
Municipal street lighting	74,942	60,223	586,084	3,084	2,821	12,234	4.1	4.7	2.1
Railroads (motive power):									
Street and interuruban	9,267,813	9,577,550	2,236,782	81,808	84,354	24,014	0.9	0.9	1.1
Electrified steam-railroad divisions	2,076,852	2,099,491	22,379	19,124	19,326	794	0.9	0.9	3.5
Other service	36,329	31,901	332,187	731	676	4,381	2.0	2.1	1.3

Less than one-thirtieth as many farms are served by municipals as by private companies. Proportionately they should have twice as many farms on their lines. The municipals are manifestly just what their name implies—the servants of the towns which institute them and not of the complete economic areas that the private can more readily reach out to serve. As a result, the municipals sell farms energy at an average rate of 5.6 cents, twice what the utilities charge on the average for this service. This must haye a deterring effect, which, perhaps, is what is often desired by the municipals. That the utilities sell more than three times as many kilowatt-hours per farm is to be expected from their much lower farm rate. These indexes bear out the fear expressed by the California Railroad Commission that growth of municipal enterprises is inimical to the interests of the farmer, no matter how favorable they may be to the dwellers in the villages and cities.

Municipal plants do not in general operate in communities where there is heavy industrial consumption of power. Even those which are in competition with privately owned utilities do not in general assume as much as the utilities do of the industrial load. Most of the industrial loading congregates around the large cities where the private utilities alone are active. These factors explain why the municipals have only 1.4 per cent of the large light and power business, whereas they have 6.03 per cent of the total kilowatt-hour output. Such large light and power customers as they have (14,364) use only 31,249 kw.-hr. per year on the average; the 379,402 large light and power customers of the power companies use 85,345 on the average, nearly three times as much. The municipal average rate is 1.7 cents, against 1.5 cents for the power companies.

Municipal residential load dominates

Nor do the municipals carry a proportionate share of the street railway and interurban load. Here the answer rests on the fact that these utility services have largely been superseded by other forms of transportation in communities of the size in which the great bulk of the municipals operate. Quite naturally their share of the railroad electrification load is even smaller and the average rate abnormally high, presumably because the Census entry represents one item that is distorted by demand or standby charges and low load factor. It can be ignored.

But the municipals do carry proportionately more residential, small light and power and street lighting load than the private companies. Although the communities are smaller for the municipals in general, they represent more compact territory than the private utilities, which on a nation-wide scale embrace suburban and rural areas with the lower customer densities per mile. The respective average rates, 4.7 cents for municipals and 5.6 cents for private enterprises, are not out of keeping with these relative conditions of distribution cost. The comment on these figures by newspaper editors was primarily on the smallness of the difference between municipal and private companies as to residential rates. They had been led by the clamor to look for a two to one or greater ratio and were surprised not to find it. Much of the publicized discussion has been founded on a few municipals that were large and favorably situated as to loading and sources of supply.

In the small light and power (retail power or commercial light and power) field is found the greatest discrepancy between the two types of utilities, municipal and private. Practice as to classification of customers is quite different here. The municipals carry a relatively larger number of small industrial establishments in this classification than do the private utilities. That largely explains why they appear to have more than their share of commercial load. The respective rates for this class of business are quite significant. The municipal rate falls practically on the generic curve (Fig. 1) for all magnitudes of consumption. The private utility rate is far out of line and this can only be attributed to policy factors.

Fig. 1—Rates for any magnitude obey economic law

National averages for all but two classes of usage fall on a smooth curve. Municipal farm rate and private utility commercial rate out of line with trend for corresponding volumes in other classes.

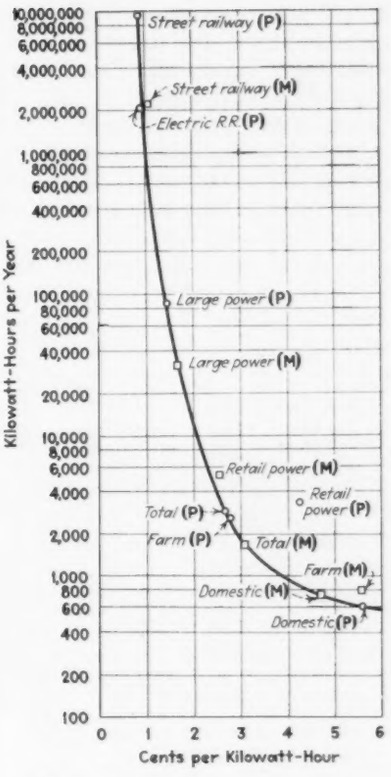
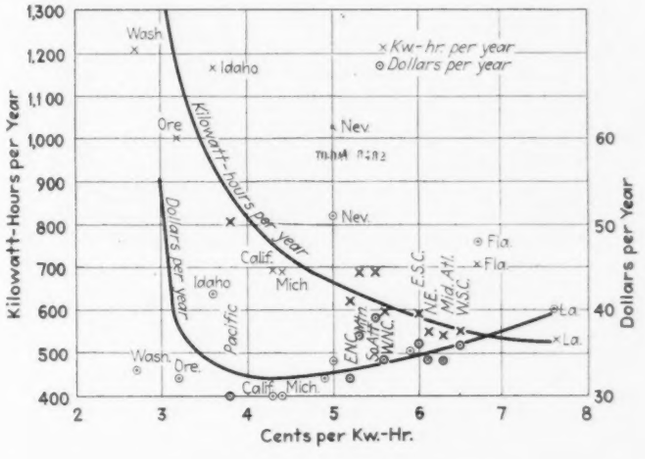


Fig. 2—Lowered rates may only lower the annual domestic revenue

Below 4 cents the bill rises again, but economic value of the service outshadows the comfort and convenience attitude toward smaller consumptions at higher rates.



An economic rate for all volumes of use

Looking at the regional figures also released by the Census Bureau, one finds some interesting facts. The Pacific states, with their abundant water power, have the lowest average rate for all output (2.1 cents). For the municipals in this region it is 2.2, as compared with 2.1 cents for the private companies. For farm service there

it is 1.6, domestic it is 3.8, small light and power it is 2.2 and large light and power it is 1.1 cents. The high average for all output is in New England, at 3.5 cents. Here the municipal average for all services is 3.9 and for private companies 3.4 cents. The West South Central states have the highest average domestic rate.

Population densities, proportions of industrial and other loads, remoteness from or nearness to cheap water power and coal, and local costs of labor and supplies are the factors which account for the range in rates in the nine geographical areas which stretch from New England to the Pacific. These factors very definitely affect the class rates and the averages. In spite of them there is, however, an evident economic relationship that places all usages on a smooth and significant curve (Fig. 1). After eliminating street lighting, which carries a special supplementary service of maintenance in addition to energy delivery, and the insignificant amount of electrified railroad energy supplied by municipals, all the other usages fall on this curve with the exception of two. Retail power by the private companies, already discussed, falls out of line and so does the farm consumption from municipals. But ignoring all the widely different influences that prompt electrical energy utilization in the different classifications, there is, nevertheless, a correlation between price and usage that seems to follow a definite economic law.

More dollars per customer the problem

This relationship can be extended into the various fields by more detailed analysis of the Census data available. Domestic rates and usage get the most discussion, so this will be taken here. In the first place the cash incomes and spending power of domestic customers are not the same in the nine geographical regions. A lowered rate in one area would not necessarily induce the same consumption and monthly expenditures for electricity as in another area where the lower rate already exists. But nevertheless there is some virtue in discussing the effect of price upon consumption on the basis that these differences are or can be made minor by aggressive cultivation of the market.

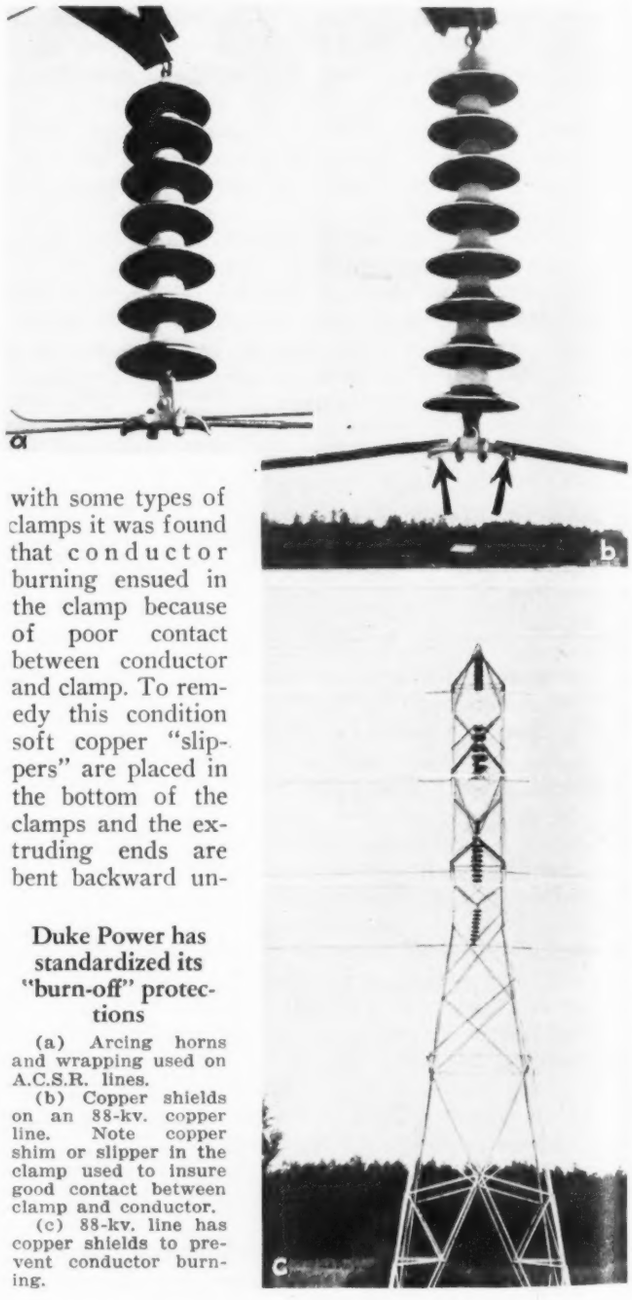
On that premise it appears that rates lowered to 4 cents increase consumption, but not enough to prevent reduction of the monthly bill. The upturn comes between 4 and 3 cents. The "dollars per year" curve in Fig. 2 rises sharply as 3 cents is approached. The basis for the extension of the curve upward is that it represents the product of rate and consumption which has been drawn to conform to Fig. 1 in this region. This technique assumes that increases in domestic consumption will conform to the curve for all uses. As soon as one passes out of the domestic realm the criterion for use of energy becomes more and more economic and less and less a decision based upon habit, comfort and intangible attributes. If, therefore, the curve of national consumption in all classifications may be taken at all as an index of local evolution, it is apparent that reduced rates are likely to mean merely more kilowatt-hours for less money unless ——. The "unless" refers to the possibility that domestic customers will use more and pay more per month at lower prices if they are educated to think (as those in the consumption brackets above them think) of the dollar value of what electricity will do as compared with competitive services of every description, laundry, refrigeration, cleaning, cooking, house heating, etc.

· · · INDUSTRY

Conductor Burn-Offs Prevented by Two Plans

Precautions against damage to copper or A.C.S.R. conductors in the event of flashovers are taken on most properties. For the Duke Power Company practices for the two types of conductors have been developed.

For copper conductors special copper shields have been designed to fit over the conductor. In addition, with some types of clamps it was found that conductor burning ensued in the clamp because of poor contact between conductor and clamp. To remedy this condition soft copper "slippers" are placed in the bottom of the clamps and the extruding ends are bent backward un-



Duke Power has standardized its "burn-off" protections

(a) Arcing horns and wrapping used on A.C.S.R. lines.

(b) Copper shields on an 88-kv. copper line. Note copper shim or slipper in the clamp used to insure good contact between clamp and conductor.

(c) 88-kv. line has copper shields to prevent conductor burning.

der the clamp. The copper shields are designed to avoid corona formation and slip into the clamp with its copper shim or slipper.

For aluminum conductors both arcing rods and wrapping of conductor are used as protection against burning. The metal horns are extended out along the conductor from the clamp. Wrapping the conductor is also practiced as illustrated. Another form of protection is to insert an outer shell of aluminum strands over the conductor near the clamp.

These devices have been highly successful in preventing conductor burning from vertical or horizontal flashovers.

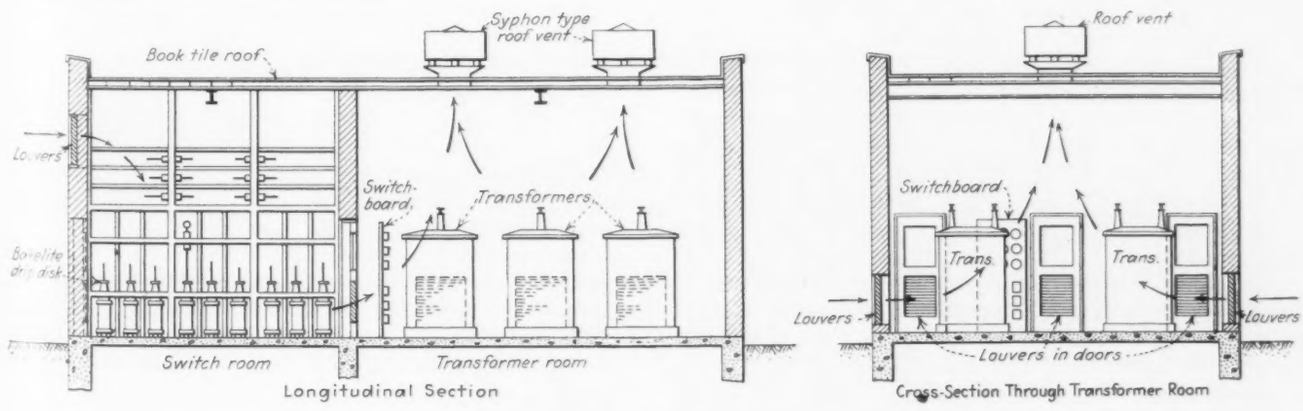
Moisture Condensation Controlled in Substations

In a recent study of moisture condensation in unattended indoor substations by 34 operating organizations it developed that trouble was experienced in 23 cases, although only two shutdowns were traced to this cause. Walls and paint were damaged in three instances, high-tension equipment was affected in eleven and switchboard equipment affected in eleven cases. Attempts to cure moisture conditions were made in 21 cases, ten of these being by the application of extra heat, three by ventilation changes and eight by both heat and ventilation. It was the consensus of opinion by the engineering group participating that heat at 50 deg. F. will usually, though not always, prevent condensation troubles; that sufficient heat is usually available from electrical losses under normal loads, but low-load conditions increase the hazard where no other heat is provided.

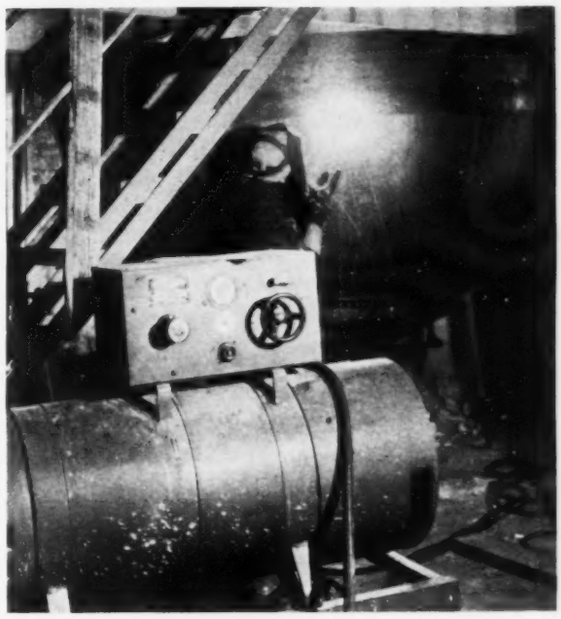
In new designs of unattended substations sixteen organizations try to prevent condensation by supplying extra heat, twelve installed automatically controlled heat, thirteen rely upon natural ventilation, six use automatically controlled ventilation, six use heat insulation on ceilings and two use it on walls. The condensation most difficult to cope with appeared to result from high humidity with sudden temperature changes. A typical design for an unattended substation equipped with siphon type roof ventilators, louvers and bakelite drip disks on the tops of the oil circuit breakers is shown.

With a wind velocity of 4 m.p.h. outside, a complete change of air every two minutes may be anticipated under normal conditions in this unattended substation

Heaters are installed in the switch room if required by local climatic conditions



Arc Welder "Stretches" Brew Kettle Capacity



Two days' time was required to stretch the capacity of this brew kettle to more than double its former capacity by means of arc welding an additional section in the center. The original kettle was cut through the center horizontally, and with the upper half of the original kettle elevated sheets were inserted and lap welded over the exterior of the original kettle and butt welded to each other. In this manner the capacity of the brew kettle was increased from 50 to 107 bbl. per day. The work was done by the Cream City Boiler Company, Milwaukee, using a Lincoln Electric Company welder.

BOOK REVIEWS

Lightning Computations for Transmission Lines with Overhead Ground Wires

By C. A. Jordan. Privately published by author (Nutley, N. J.). 82 pages, illustrated. Price, $5.

Desire to aid the engineers of client companies of the Electric Bond & Share Company in obtaining a better understanding of the mechanism of lightning and of the protection against it was the circumstance which inspired the preparation of these extensive notes. The author was seeking a method of solving the lightning voltages and currents which would lend itself directly to practical design of transmission lines and their protective adjuncts. It determines the wave values for successive reflections after lightning hits to tower or the line in midspan. After establishing the technique the book devotes about one-fourth its pages to a detailed computation of a ground wire design with typical proportions.

The virtue in the presentation rests in the simple polynomials which evolve from the summation of a series of terms representing the successive reflections. Voltages at the tops and bases of towers and currents in the ground wires are expressed in terms of these literal series. Another third of this zinco work deals with surge impedances and coupling with one and with two ground wires. There is also a discussion of effective height and radius of conductors as well as of impedance in the lightning path itself. The book constitutes a guide and a working tool for the transmission line designer.

The Valuation and Regulation of Public Utilities

By John H. Gray and Jack Levin. Published by Harper & Brothers 49 E. 33d Street, New York, N. Y. 143 pages. Price, paper 75 cents, cloth $1.

"The crowning decision that emasculated effective regulation . . . was the Supreme Court declaration . . . that the compensation constitutionally protected and assured to public utilities is 'a fair return on the fair value of the property.'" Apparently the authors do not believe the word "fair" belongs in the vocabulary of rate regulation. Nor do they believe in the Supreme Court, which they call "a political policy-determining court" which "has become one of our chief political organs of government solely through its power of nullifying regulations and laws." The Presidents over the years should have chosen their Supreme Court appointees from the staffs of the Interstate Commerce Commission and these two authors just know they could have made better judges. Everything they did for the I.C.C. was divinely right and everything that the railroads and utilities have done to get fair valuations and fair rates has been satanically wrong.

Manifestly this is a highly prejudiced treatment of the regulatory situation, factual only from the railroad side, discursive and brief as to the electric utilities. It is quite the opposite of the impartial perspective of the problem which the editor-in-chief of these "Current Economic Problems" brochures assures you in the introduction when he says "the sole editorial suggestion has been that each writer subordinate his own views to the primary aim of carefully analyzing the problem and stating the controversial issues in a manner to promote further thought on the part of the reader." There is practically nothing new in the book to help solve the regulatory muddle.

Procedure Handbook of Arc Welding Design and Practice

Published by the Lincoln Electric Company, Cleveland, Ohio. 434 pages, illustrated. Price, $1.50.

This handbook presents basic data and current practice in arc welding. It covers the essentials of the process and data for use in welding steel, iron and non-ferrous metals. The treatment of weld metals and of welds is extremely thorough and the practical applications of welding are taken from current practices in all fields. This book should be very valuable to managers, welders and students.

Signals and Speech in Electrical Communication

By John Mills. Published by Harcourt, Brace & Company, 383 Madison Avenue, New York, N. Y. 281 pages. Price, $2.

With never a diagram or a formula to disgrace the page "Long Lines" Mills has painted a word picture of the electronic mechanism of speech transmission for the layman. Naturally to an engineer the explanations are devious and ponderous, but somehow the detours and the loading seem to be just what the lay scientist can best grasp. The frequency spectrum, modulation, side bands, echoes, Pupin coil yielding to the repeater, rebirth of telephony with the audion are handled in this way. Picture transmission, television, multiple channels and selective filtering are also told in the vein of "Letters of a Radio Engineer to His Son." One can hear sonny saying, however, "Dad, *draw* me a picture of how it works."

Grundlagen des Elektrischen Schmelzofens

(Fundamentals of the Electric Melting Furnace)

By Johannes Wotschke. Published by Wilhelm Knapp, Halle. 505 pages, 254 illustrations. Price, paper, 42 reichsmarks; bound, 44 reichsmarks.

Theoretical, technical and economic aspects of electric furnace operation are passed in review, including auxiliary equipment. Electrical characteristics are analyzed with the aid of equations and graphically, separate chapters being devoted, for example, to symmetrical and unsymmetrical types, and to an analysis of the "dead phase." In the section on constructional features and functional characteristics various factors bearing on performances are successivly examined. The economic section includes energy and heat flow charts, efficiency computations and materials balance with useful numerical examples. Most of the treatment refers to arc furnaces, although the induction type is not overlooked.

The work should be of particular interest to electric furnace operators and engineers concerned with the design of new installations.

NEWS OF THE WEEK

Capital Contact Service Engineering Council Aim

Faced with a budget for the year of only $24,942, the American Engineering Council will attempt to serve the needs of organization members mainly through the development of Washington contacts and the relation of those contacts to the specific requests made by member organizations, Executive Secretary Frederick M. Feiker stated this week.

"The thought that the American Engineering Council functions as the Washington Embassy for engineers and engineering has had very wide acceptance," Mr. Feiker said. Eventual plans of the council call for a well-knit organization in which contacts on national affairs will be maintained at the principal industrial and engineering centers, designed to act as a sounding board for the council on national affairs and to initiate ideas in respect to them.

"The eventual program," states Mr. Feiker, "does not contemplate duplication of the work of other organizations, but is pointed toward discovery of some way of relating the council and its definite functions to all organizations which possibly would be interested in the development of such a relationship. In furtherance of this program the council proposes actively to relate as many of these groups as possible to the organization's common purpose and interests, within its present constitutional limits."

Associated Press Photo

His suit against extradition to Chicago denied by the Ontario Court of Appeals, Martin J. Insull leaves court for the Toronto jail to await arrival of Cook County officers who are to return him to the United States

Grand Coulee Plans

Construction and operation of the Grand Coulee power project on the Columbia River, between Washington and Oregon (ELECTRICAL WORLD, January 13, page 90) will be undertaken by the federal government, the Public Works Administration has announced. P.W.A. previously had approved Grand Coulee as a state project, subject to a contract entered into by the government and the state.

Insull Quits Greece for Sea

FOLLOWING a fantastic attempt to flee Greece aboard a small chartered freighter, Samuel Insull was forced to return there under the Greek government's peremptory orders before again putting to sea in his little tramp ship *Maiotis* this week. Greece willing, he steamed out into the Mediterranean in search of a haven of unextraditability. As Greece apparently washed her hands of further responsibility for the movements of Mr. Insull, legal activity on his behalf concentrated on finding a country, however small and wherever it might be located, wherein he might settle, free from danger of deportation to the United States. Late this week no definite decision on a future home for Mr. Insull had been announced. The *Maiotis* is under charter until April 30.

Martin Insull extradition upheld

Meanwhile, in Toronto, Martin J. Insull, disdaining the prison fare of the Toronto jail, began a hunger strike while awaiting Cook County, Illinois, officers to return him to Chicago for trial as an embezzler. Confirmation of the writ of extradition against Mr. Insull was issued last week by the Ontario Appellate Court, climaxing a fight which spread over more than seventeen months of court battles.

Rumors concerning Samuel Insull's plans were rife in the week before his first flight from Greece. When the Greek government announced that it had set a final time limit for Insull's departure and had provided him with papers permitting him to cross the country's borders, the harassed fugitive was at various times reported as negotiating with Balkan, Near Eastern and African nations for a visé, and also that he contemplated surrender to American authorities and a return to the United States. Finally, 24 hours before the time set by the Greek government for his departure, Insull walked from his apartment with two companions, sped by car to Piræus, the port of Athens, and boarded the privately chartered freighter *Maiotis,* which immediately put out to sea. His means of escape discovered two days later, government officials ordered the freighter back to Athens. There, after rumors that Insull would be turned over to American authorities were met by threats of further actions in the Greek courts by his attorneys, the government announced that it was permitting Insull to sail with his ship, and that it now considered the entire affair closed.

Middle West reorganization imminent

That a reorganization of Middle West Utilities Company is not only possible, but imminent, marks a brief filed by Attorney Robert N. Golding on behalf of the receivers for Middle West, Insull Utilities Investments, Inc., and the Corporation Securities Company with the Chicago federal District Court. The brief, one of two filed by attorneys who participated in the recent hearing of Samuel Ettelson's charges, on behalf of 160 Middle West Utilities common-stock holders, of fraud and collusion in the present receivership, pictures the receivership as untainted and taken as the safest step in behalf of all concerned.

Posthumously disclosed in a statement of Moe Rosenberg, political boss and junk dealer, who died last January in the midst of a federal investigation of his income tax payments, further charges of wrongdoing creep out. In this statement, which purported to show why he had made no return on some $500,000 he received in two years from utilities company junk contracts, Rosenberg alleged that Samuel Insull was the source of the funds, which he in turn paid to a number of politicians, including the late Mayor Anton J. Cermak.

Load Building Keynote of Seattle Power Meeting

That commercial development will provide the salvation of electric utilities was the keynote struck at the recently completed ninth annual conference of the Business Development Section of the Northwest Electric Light and Power Association, held in Seattle, Wash. Marked by a greater attendance than that of previous years, the meeting built its program around the assertion of L. R. Coffin, vice-president Puget Sound Power & Light Company, that rate structures are made by the people who use the service and that the price of power to the public depends more on load factor than on investment in plant.

Interest centered on several topics of discussion, chief of which were the possibilities for load development in the commercial and industrial fields through adequate customer contacts; new methods for increasing farm consumption; reaching the lower income brackets in fairly well-saturated range territories through rental and long-term credit plans, and improvement of relations between utility and dealer through making it possible for dealers to obtain active co-operation from utilities in promoting appliance sales.

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E.E.I. Convention Plans

According to preliminary announcements the Edison Electric Institute will hold four general sessions at its second annual convention in Atlantic City, June 4 to 7. These general sessions will spread over three days and will be open to all interested in the electric light and power industry. The first day of the meeting, June 4, has been reserved for executive meetings of institute members and the afternoon of the second day is set aside for committee meetings.

Gathering at the Traymore Hotel, the convention will be addressed by industry speakers as yet unannounced. A modest recreational program is planned. Reduced railroad fares will, as in the past, be available to members of the institute.

Shoals Charges Die

Apparently to evaporate in thin air after more than six months of inactive investigation, the one-day "major scandal," at Muscle Shoals, involving charges of "power theft" against Alabama Power and Tennessee Electric Power companies almost a year ago (ELECTRICAL WORLD, May 27, page 659) may come to naught. In commenting on the report that Huston Thompson, acting as a special investigator appointed by President Roosevelt under the T.V.A. act, would further postpone his statement of investigation, President W. L. Willkie of the Commonwealth & Southern Corporation has stated: "The unfortunate part is that the accusation was made in headline front-page articles and the vindication has appeared months later without apparent news value."

E.E.I. Tackles Its Sales Problems

Commercial committees of Edison Electric Institute review progress in "Better Light—Better Sight," in ranges, refrigerators, water heaters, small appliances and air conditioning. Plans for further development outlined.

URGENT—needed immediately—more sales of refrigerators, ranges, water heaters, lamps, small appliances, industrial power and heating equipment, all to add up to increased consumption and decreased electricity cost to users, and to result finally in the restoration of prosperity to that forgotten man—the utility stockholder. That was the apparent intention animating the Edison Electric Institute sales conference in Chicago, March 14 and 15. There could be sensed at the conference a difference from the utility sales meetings of years past, a difference marked by perhaps less enthusiasm but more determination toward the improvement of energy sales.

Among the witnesses appeared M. E. Skinner, who spoke of "Better Light—Better Sight" campaign activities. He pointed out that a year ago there were twenty sight meters in commercial use; now there are 5,000. He told of other interests now becoming active in the campaign. For example, optometrists are beginning to consider light intensities in their prescriptions for vision correction and paint manufacturers have taken hold of the sight meter to demonstrate the reflection quality of their products. The campaign, stated Mr. Skinner, is furnishing proof that sales follow education, that the public is interested and grateful for information from which it may benefit, and that the prime consideration in carrying the message to the public is to keep it always and forever simple in its essential terms.

There are plans now being formulated for the fall activity in lighting promotion, of which details will be announced later. These plans will tie in with a big program of advertising by the lamp manufacturers and will include consideration of means to improve portable lamps so that they may have their place in scientific illumination.

Must sell small appliances

Less than 50 per cent of domestic users of electricity are prospects for the three major load-building devices, range, refrigerator and water heaters, said D. M. DeBard, chairman of the table cookery program committee. More than half the domestic customers on the utility lines use less than 30 kw.-hr. per month and it is apparent that these customers are prevented by their economic status from investment in the large equipment. Therefore to these customers must be sold the small appliances they can afford to buy and use. Under the chairmanship of Mr. DeBard a committee composed of C. E. Swartzbaugh, R. W. Turnbull, F. R. Kohnstamm and C. E. Greenwood has adopted the slogan "Electric Table Service Saves" for a six-month program beginning this month for the promotion of small appliances. The idea of this program is identical with that which is proving so successful in the "Better Light—Better Sight" campaign. It includes no coordinated extensive national advertising, no sales plan. It merely urges all retail outlets for small appliances actively to promote their sale and use. The activity will be stimulated by publications and advice from institute headquarters and reliance placed in this to stir up and to keep stirred up the promotional enthusiasm of the local outlets.

Ranges can be sold

Do the utilities want to go ahead with the electric range or do they want to drop it? With this question, Pierre Miles introduced an all but brutal analysis of the cost of putting range load on the lines. Waving aside as imaginary the frequently cited obstacles of too high prices for ranges, for current and for installation, of difficulties of service and other familiar objections, Mr. Miles stated baldly that the range load could be had if the utilities were willing to pay for it. He became specific in the exposition of his fundamental truth that the people must be sold on electric cooking. He set up a five-year plan for the sale of 5,000 ranges in a typical American city. This plan shows that in the first year the utility must expect to pay about $75 for each range sold, this figure decreasing year by year until in the fifth it is turned into a profit of $6.35, the total selling expense per range for the full quota over the five-year period averaging $16.30. This, in terms of cost per dollar of annual gross revenue connected, ranges from $1.69 in the first year to a profit of $0.14 in the fifth, and an average over-all cost of $0.36. It is such a program as this, high in cost during the first years of its operation, that each utility must embark upon if the electric range is to come into its own.

The cost of isolated plant equipment is rising, said W. H. Sammis, and purchased power is becoming proportionately easier to sell. In the present state of industrial plants, with huge accumulations of deferred maintenance and small investment in new productive equipment in the past few years, manufacturers are more inclined, in the face of the present rising market, to put their money into productive facilities rather than lay it out in power plant investment. As an accompanying reason for cheerfulness, Mr. Sammis pointed out the increasing acceptance of electric heat in industrial processes. To realize on this trend the utility must put greater man-power into power sales. This requirement was echoed by H. W. Thuerk, who stated that the radical changes in industrial operations imposed by NRA are making it necessary to put more time and more men on the job of selling power.

Another significant contribution to the temper of hopefulness in this session of the conference was furnished by C. E. Michel, who climbed up on his hobby of air conditioning and, putting it through its paces, proved that it was not a hobby at all, but a good, strong, willing horse, able to lean forward in the traces and pull. The cost of air-conditioning equipment is going down. Industrial air conditioning is developing rapidly, is extending beyond those special industries in which it is recognized as a requirement of the manufacturing process. The average self-contained room cooler uses more than 1,200 kw.-hr. and the air-circulating fan 400 during the cooling season.

T.V.A. is rendering a real public service in emphasizing the value of increased use and in providing electric devices at low cost per unit. It is my judgment that the cost of the electric range, the electric water heater and the other large household users of energy can be greatly reduced if their production can be put on a quantity basis and their sale effected without the heavy distribution cost now entailed.

HENRY I. HARRIMAN,
Chairman New England Power Association.

Discussing "What Makes Electricity Cheap" before the Chattanooga, Tenn., Chamber of Commerce, Mr. Harriman, also president of the Chamber of Commerce of the United States, expressed a cordial attitude toward T.V.A., yet warned his hearers against harmful government interference.

New water heater program

An electric water heating program that leaves the plumbing aspect of the job entirely up to the customer was described by E. A. Brand. The utility converts the user's range boiler into an electric water heater by installing strap-on heating units, insulation and thermostats. The total cost of this conversion to electric operation is about $40 to the customer.

Although his paper opened the conference, George E. Whitwell's proposal of a five-point sales program on refrigerators, ranges, water heaters, small appliances and miscellaneous, including lighting, air conditioning, etc., constitutes an effective summary for the closing of this report. The government, said Mr. Whitwell, can offer rates to build load, but the utilities must build load to lower rates. If forced cuts of top rate blocks are made, then intensive effort must be put upon small appliances whose use will increase consumption in these blocks. Sales effort must be concentrated on the heavy appliances, on the small appliances, on lighting; must, in fact, be concentrated upon every device and service that uses electricity, which means, of course, no concentration at all, but good, hard, persistent effort in every line.

New England I.E.S. Learns of Lamp Developments

Recent developments in reduction of tolerances in lamp manufacture were reviewed by Hygrade-Sylvania engineers speaking before the meeting of the New England section of the Illuminating Engineering Society at the Hygrade-Sylvania Corporation factory.

The trend toward securing greater uniformity in individual lamps to conform to achievements in attaining group uniformity was stressed to approximately 100 listeners. Ten years ago 3 per cent of the lamps deviated from the required mean lumens per watt, and today less than 0.5 per cent vary above or below the required limits. While 70 per cent deviated from the predicted mean life a decade ago, today only 10 per cent so vary, with a prediction accuracy established to within 30 to 40 hours. Improved mathematical study of lamp burning, development of better materials and more rigorous checks during manufacture are responsible for the improvements, the meeting was told. Stem and over-all length tolerances are now 0.5 mm., and photometry has been greatly improved, readings required being within 0.5 per cent.

New lamp developments include "three-light" units for store use, a 100-watt mill-type lamp to withstand vibration, a new 250-watt indirect lamp and a 15-watt vacuum cleaner lamp.

Coming Meetings

Edison Electric Institute—Engineering Committee Meetings, Cleveland, Ohio, March 26-29. Convention, Atlantic City, N. J., June 4-7. B. F. Weadock, 429 Lexington Ave., New York.

Association of Iron and Steel Electrical Engineers—Youngstown, Ohio, April 12. J. L. Kelly, Empire Building, Pittsburgh.

Missouri Association of Public Utilities—Excelsior Springs, Mo., April 19-20, R. N. Beagle, 101 W. High St., Jefferson City, Mo.

Electrochemical Society — Asheville, N. C., April 26-28. Colin G. Fink, Columbia University, New York.

National Fire Protection Association—Atlantic City, N. J., May 14-18. A R. Small, 109 Leonard St., New York.

American Institute of Electrical Engineers—Northeastern District meeting, Worcester, Mass., May 16-18. Summer Convention, Hot Springs, Va., June 25-29. H. H. Henline, 33 W. 39th St., New York.

American Society of Mechanical Engineers—Semi-annual meeting, Denver, Col., June 25-28. Calvin W. Rice, 29 W. 39th St., New York.

Michigan Electrification of Farms Progresses

Indicative of the strides being made in rural electrification in some states is the fact that there were 38,633 electrified farms in Michigan at the end of 1933, as compared with 8,218 reported by the 1927 census of electrical industries. More than 22 per cent of 169,372 farms in the state now have central station electric service, according to the Utilities Information Bureau of Michigan. The new farm customers taken on in 1933 by the larger companies totaled 2,564.

The Farm Service report of the census shows that in 1932 Michigan had the lowest average farm rate for electricity of any state east of the Mississippi river (4.6 cents per kilowatt-hour). The rate in 1933 was still lower. The only states with lower rates were California, 1.5 cents; Washington and Oregon, 2.6 cents; Louisiana, 3.3 cents, and Texas, 3.5 cents, and these lower rates come about through the use of, in all cases, more than five times as much energy per farm as Michigan's 725 kw.-hr. per year. For instance, California's 61,132 farm customers use an average of 15,551 kw.-hr. a year, primarily for irrigation pumping.

Owners Told Storm Story

That shareholders might appreciate the problems and loyalty of employees in maintaining and restoring service during such storms as swept New England last month (ELECTRICAL WORLD, March 3, page 342) Connecticut Light

& Power Company has distributed to all stockholders a description of the fight against the storms, written by a company employee. Under the title "The Power Must Not Fail" there is related the story of the successful struggle at the Devon power plant to keep the fast-emptying bunkers supplied with coal and the long fight against ice, drifts and wind waged by the line crews in repairing breaks in the ice-burdened lines.

Seattle Tax Upheld by Supreme Court

Maintaining that a municipality is within its constitutional right in taxing the gross income of a private utility corporation competing with the municipal enterprise, the United States Supreme Court this week upheld the Seattle ordinance imposing a 3 per cent tax on the gross income of the Puget Sound Power & Light Company, Seattle. The high tribunal had granted the companies a review from a lower court decision upholding the city ordinance (ELECTRICAL WORLD, October 21, 1933, page 519, and February 17, 1934, page 274).

While there was no contention on the part of the Puget Sound utility that its franchise relieved it generally from the duty of paying taxes, the company did contend that the tax levy contravened the Fourteenth Amendment and contract clause of the Constitution in so far as it affects a business with which the taxing sovereign is actively competing. For that reason, the company claimed, the taxation involves a forbidden discrimination and deprives the utility of its property without due process since the combined power of the city to tax and to compete may be used to destroy the private company's business.

State may compete and tax

Justice Stone, who wrote the opinion, said: "In conducting the business by state authority the city is exercising a part of the sovereign power of the state which the Constitution has not curtailed. The decisions of this court leave no doubt that a state may, in the public interest, constitutionally engage in a business commonly carried on by private enterprise, levy a tax to support it . . . and compete with private interests engaged in a like activity. . . . The injury which appellant fears may result is the consequence of competition by the city, and not necessarily of the imposition of the tax. Even without the tax the possibility of injury would remain, for the city is not bound to conduct the business at a profit.

"Legislation may protect from the consequences of competition, but the Constitution does not. . . . The Fourteenth Amendment does not purport to protect property from every injurious or oppressive action by a state. . . . It does not preclude competition, however drastic, between private enterprises or prevent unequal taxation of competitors who are different. Those were risks which appellant took when it entered the field. No articulate principle is suggested calling for the conclusion that the appellant is not subject to the same risks because the competing business is carried on by the state in the exercise of a power which has been constitutionally reserved to it from the beginning. . . ."

Virginia Tax Bill Signed

After prolonged hearings in the Virginia Assembly and bitter debate in the Senate, the so-called "Peery tax bill," providing by tax adjustments and increases approximately $1,200,000 annually in new revenue, was signed this week by Gov. George C. Peery.

Net Income Bill Vetoed

Vetoing the bill passed at the recent special session of the Texas Legislature, which sought to fix the maximum net income of utilities at 10 per cent, Gov. Miriam A. Ferguson stated that "if this bill were approved it would leave two statutes on the same question with conflicting provisions, one placing a restriction of 500 population and the instant bill removing all population restriction. It will require another law to correct these contradictions."

Detroit Bills Utilities Under Street Rental Law

Overdue bills totaling $1,485,000 and a current monthly charge of $135,958.35, under an ordinance effective March 15, for the rental of city streets and alleys have been sent to the Detroit Edison Company by the city Controller. The bills to the utility are predicated on a report made by William S. Sayres, federal master in chancery, that the city ordinances on which the charges were based are legal, and that the city may charge a rental against privately owned utilities for the space occupied by underground pipe lines, conduits or cables. The report does not have the effect of a judicial decree until confirmed by a federal judge.

Detroit Edison Company and the Michigan Bell Telephone Company and the Detroit City Gas Company, which have also received rental bills, have not indicated what action they contemplate taking in the matter, but it is pointed out that the companies never agreed to the rental and under the city's laws the only recourse in case of non-payment is ejection.

MERRY-GO-ROUND

Objection by Representative Cooper, Ohio, blocked a vote this week on the proposed investigation of light and power rates throughout the country. The measure probably will come before the House again on April 2. Representative Rankin, Mississippi, sponsor of the measure, declares it to involve not an investigation of power companies, but only a census in which all power rates will be reduced to a common denominator so they may be understood and compared.

Consideration of the Johnson bill to limit the jurisdiction of federal courts over rate cases is not to be taken up by the judiciary committee of the House until the first of the month.

No progress has been reported during the past week on the electric light and power code. One of the causes of delay is the development of certain fundamental changes in NRA policy. This not only includes even shorter hours but also an increased responsibility of code authorities.

Indications are that the Wagner bill strengthening section 7-a of the NRA act, from the standpoint of organized labor, will be greatly modified before securing the approval of Congress. The 30-hour bill has little chance of becoming law.

PAUL WOOTON,
Washington Correspondent.

Texas Court Upholds Utility Merchandising

In a decision handed down last week the Texas Supreme Court upheld the right of public utility companies to sell at retail appliances and equipment for use in connection with the services which they furnish consumers. The decision, which is regarded as of far-reaching importance to utility companies operating in Texas, follows months of contention in the various state courts (ELECTRICAL WORLD, June 17, page 783).

The suit was brought some time ago by Attorney-General James V. Allred against the San Antonio Public Service Company. An injunction was granted by the district court at Austin restraining the company from purchasing and selling electric and gas appliances and operating buses under certain conditions, but the state Appellate Court dissolved the injunction. Appeal to the state Supreme Court followed.

Court Upholds Power Sale

Confirming the ruling of the Pennsylvania Public Service Commission (ELECTRICAL WORLD, February 4, 1933, page 147), Judge William H. Keller of the Superior Court in Harrisburg has granted the Pennsylvania

Water & Power Company the right to sell hydro-electric power to the Pennsylvania Railroad and several electric light companies.

Railroad Electrification Progresses in Italy

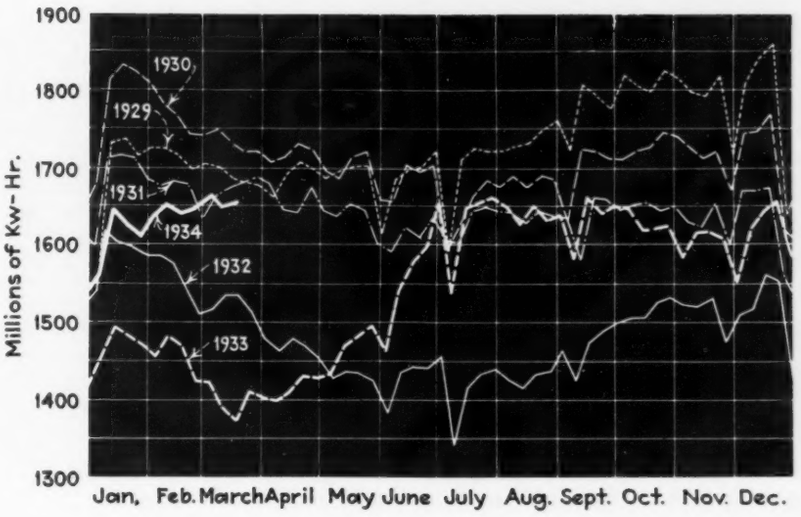
Electrification of Italian railroads to cut the coal consumption required by the State Railways and make further use of the existing hydro-electric plants is going forward. Present plans could raise the electrified mileage from 1,362 miles to 45 per cent of the total mileage, or approximately 4,100 miles by 1943 (ELECTRICAL WORLD, March 25, 1933, page 374). The new electrified line from Bologna to Florence, not that already electrified between these towns via Pistoia, will be completed and inaugurated this year. By 1937 the line from Salerno to Reggio Calabria will be completed, marking the completion of the whole line from Brennero to Sicily, to be the longest electric line in Europe—about 1,250 miles.

In line with the relative cost advantages of direct current over three-phase supply for lines already in operation (ELECTRICAL WORLD, August 12, 1933, page 210), which indicate a saving of 50 per cent for substation and overhead line costs alone, most of the new lines are being built for 3,000 volts d.c. instead of for three-phase, 3.7-kv., 16⅔-cycle current employed in other lines, principally those crossing the Alps. For the new direct line from Bologna to Florence, which, incidentally, is the first Italian State Railway line built entirely for electric traction, the Societá Italiana Ernesto Breda of Milan has just delivered a new type of electric locomotive to be operated at 3,000 volts d.c., rated 3,000 hp. and having a total weight of 122 tons. Its over-all length is 54 ft. and in tests on the line a maximum speed of approximately 105 m.p.h. was attained.

Municipals Report

Upon the basis of questionnaires submitted to 188 municipal utility cities and 23 county water districts in the state, the California Municipal Utilities Association has shown more than 70 per cent of the capital investment in California municipal utilities to have been retired thus far out of plant earnings, and that municipal utilities have returned to their cities' general funds an average of 19.52 per cent of gross earnings. Excepting four municipal plants exempted because of "peculiar" local conditions, every California municipal electric plant is alleged in the report to be selling more kilowatt-hours of electricity for $3, the average domestic combination electric service bill, than does the largest private utility there.

Output Gain Breaks Record



Scoring an increase of 20 per cent, the greatest on record, over the preceding year, the output of central electric light and power stations during the week ended March 17 climbed slightly, compared with the week before, to 1,650,013,000 kw.-hr., according to the Edison Electric Institute. While the corresponding week's output in 1933 was the smallest of that year and with one exception the smallest during the entire depression, this accounts only in part for the present extraordinary excess. For two months the trend has been distinctly upward, an unusual condition at this season.

Output two years ago was again surpassed by 7 per cent and that of the highest comparable week—March 15, 1930—was approached within 5 per cent.

Progress in the Central industrial area brought a 30 per cent gain over 1933, in New England nearly 15 per cent and changes only a little less striking in other sections.

Weekly Output, Millions of Kw.-Hr.

1934	1933	1932
Mar. 17...1,650	Mar. 18...1,375	Mar. 19...1,538
Mar. 10...1,647	Mar. 11...1,391	Mar. 12...1,538
Mar. 3...1,658	Mar. 4...1,423	Mar. 5...1,520
Feb. 24...1,646	Feb. 25...1,426	Feb. 27...1,512
Feb. 17...1,641	Feb. 18...1,470	Feb. 20...1,545

Per Cent Change from Previous Year

Region	Week ended Mar. 17	Mar. 10	Mar. 3
New England.....	+18.2	+17.0	+15.7
Middle Atlantic....	+14.7	+14.1	+15.3
Central Industrial..	+30.1	+27.6	+24.6
West Central.....	+13.8	+12.7	+10.0
Southern States....	+17.5	+18.5	+11.9
Rocky Mountain...	+16.8	+15.7	+18.2
Pacific Coast.....	+12.0	+ 7.9	+ 7.7
United States....	+20.0	+18.4	+16.5

Plan Mine Power Service

Final arrangements have been made by the Ontario Hydro-Electric Power Commission for the construction of a power development on the Albany River at the north outlet of Lake St. Joseph, to serve mining companies in that region. Total expenditure by the commission on the development will be in the neighborhood of $300,000. Two of the mining concerns are assuming joint responsibility for 28 miles of power line to the extent of $40,000 each. Construction work on the project will be started immediately.

Hydro Capacity Gains

According to the U. S. Geological Survey a gain in hydro capacity of 0.6 per cent was made during 1933. The increase of hydro-generating equipment was 95,500 hp. to a total of 15,913,451 hp. An estimate based on the present practice of installing hydro equipment is that the United States would have to have a total installed capacity of 80,000,000 hp. to use its potential water power, so that at present there is only a 20 per cent saturation of hydro-generators.

New Unit at Rapide Blanc

That the construction program of the Shawinigan Water & Power Company is well ahead of schedule despite adverse weather conditions was indicated this week when the second of four units of 40,000 hp. each being installed at its Rapide Blanc hydro-electric development in Quebec was put in operation. The completion of these two units increases the present capacity of the company to 809,200 hp. As indicated previously (ELECTRICAL WORLD, February 3, page 202), the other two units will be completed in the early summer of the present year.

As to Rates——

• Jersey Central Power & Light Company has been charged with a "write-up" of $5,697,695 in its fixed capital after its merger with the Eastern New Jersey Power Company in 1925. The charge was made last week in connection with a petition of Monmouth County consumers for a $25,000,000 reduction in the company's rate base and a 28 per cent cut in total rate schedules.

• Public Service Company of Northern Illinois encountered costs of $87,500 in 1933 with $70,000 additional to be charged off in the next two years, in connection with the current investigation of electric rates charged by the company, S. B. Cushing, company statistician, testified before the Illinois Commerce Commission (ELECTRICAL WORLD, March 17, page 419). Property appraisals and legal fees resulting from the commission's order requiring the company to show cause why its electric rates should not be temporarily reduced will cost a total of $157,500, the witness said. The proportion allocable over a three-year period amounts to approximately $105,600. The maximum the company could be required to pay under the state law was estimated at approximately $128,500, or one-half of 1 per cent of 1933 electric revenues of about $25,700,000.

• Savannah Electric & Power Company has accepted a rate cut through agreement with the Georgia Public Service Commission which will save small commercial users of power about $40,000 annually. Previously the company had put into effect the rates of the Georgia Power Company, at an estimated saving to domestic consumers of $130,000 annually. New rates for small commercial users range from 8 cents per kilowatt-hour for the first 200 kw.-hr. to 2 cents for all over 2,000.

• Niagara, Lockport & Ontario Power Company has announced a new schedule of lower rates effective April 1. Reductions from 9 cents to 8 cents per kilowatt-hour are slated for the villages of Alexander, Attica, Corfu, Elba, Le Roy and Oakfield. No reduction is made in Batavia, which has a 7-cent per kilowatt-hour top rate.

• Indianapolis Power & Light Company must pay for an appraisal of its property by commission engineers, according to an order issued last week by the Public Service Commission. The commission is believed to be pointing toward further reductions in the company's rates, despite the 8 per cent reduction which went into effect on February 6 (ELECTRICAL WORLD, February 24, page 311). The utility, through its counsel, has indicated its willingness to pay the expenses incurred by the appraisal.

• Central States Electric Company's new light rate schedule for Cedar Rapids, Iowa, has been approved by the City Council and goes into effect March 24. A minimum bill of $1 is provided for, domestic consumers being charged 6 cents for the first 30 kw.-hr., 5 cents for the next 30 and 3.7 cents for the next 40. All over 100 is charged at 2.5 cents per kilowatt-hour. The old rate was 11 cents on a turning point basis.

• Virginia Public Service Company, a report on whose electric properties was reviewed by the State Corporation Commission last week, may be forced to establish separate rates in Newport News and Arlington County if the petitions of that city and county are granted. Reviewing the Allen J. Saville report (ELECTRICAL WORLD, March 3, page 347), the commission heard J. Cloyd King, representing the company, claim that the Saville valuation estimates are too low by approximately $4,000,000 and that the actual earnings of the company in Virginia will be less than 4 per cent in view of the new state taxes and NRA requirements.

• Georgia Power & Light Company was granted an injunction last week restraining the Public Service Commission from enforcing a rate cut which the three-judge federal court ruled would deprive the utility of a fair return on its investment. The new rates, scheduled for April 1, would have been practically the same as those recently ordered for the Georgia Power Company. Evidence presented the judges, the order said, showed the company's rate of return, after deduction of 3.5 per cent for depreciation, varied from 3.63 per cent in 1928 to 3.59 per cent in 1933. In 1932 the return was 4.1 per cent. The company's property investment was placed at $4,000,000. The decision pointed to purchase of power by the company from the Florida Power Corporation as one reason why its rates could not be reduced to conform with those of the Georgia Power Company.

• Ponce Electric Company, San Juan, P. R., of which the Stone & Webster Service Corporation of Boston is the transfer agent, has refused to accept the order of the Public Service Commission on March 10 reducing its rates, earnings and valuation approximately one-half. Late last week the members of the commission were served with a notice of a federal court hearing on an injunction petitioning that the order be voided as confiscatory of property, contrary to the Constitution. The company alleges that its property has a replacement value of $1,480,000 with an actual investment of $1,250,000, and that it has been assessed at $900,000 for taxation purposes for the last three years by the insular government, whereas the commission placed the valuation at $708,000 as a public utility. Meanwhile, the hitherto ineffective light boycott at San Juan become active, with fully 75 per cent of the city's advertising signs and store windows dark.

Municipal Items

MOBERLY, MO. — Election on a $700,000 bond issue to finance alterations and additions to the municipal light and power plant has been postponed until April 24. The election was to have been held March 20. The P.W.A. has allotted $700,000 grant and loan for these improvements.

FALMOUTH, MASS. — City has registered a vote of approval for the construction of its own electric light and power plant.

SEATTLE, WASH.—As the result of a budget cut which reduces the general fund appropriation for street lighting from $438,750 to $375,000 in 1934, the department of lighting will furnish the current and maintain the system at the unprecedentedly low figure of 1.88 cents per kilowatt-hour. During 1933 the department was paid at the rate of 2.2 cents per kilowatt-hour for street lighting.

FRANKFORT, N. Y. — Despite the failure of the Utica Gas & Electric Company to obtain an injunction restraining this village from proceeding to purchase a $63,000 Diesel power plant, when the State Appellate Division ruled in favor of the city, it is understood that the village trustees are at present against purchase and favor continuance of the existing contract with the Utica utility.

MITCHELL, NEB.—Bonds for $30,000, the proceeds of which are to be used in taking over the distribution line here of the Western Public Service Company, have been issued in compliance with court appraisal.

SUMNER, IOWA—Holding that the injunction granted against Fairbanks, Morse & Company and the town of Sumner to prevent erection of a municipal electric light plant was valid and should be upheld, the Iowa Supreme Court set aside the election at which the municipal plant was voted. The reason cited by the court for its decision was that the ballot in the special election did not show how funds were to be obtained for purchase of the plant. The suit for injunction was brought by the Central States Power & Light Corporation and other town property owners.

FINANCIAL · · · BUSINESS

Conversion Plan to Meet Virginia Power Maturity

Offer to exchange Virginia Railway & Power Company first and refunding mortgage bonds due July 1, 1934, for equal amounts of Virginia Electric & Power Company secured convertible ten-year 5½ per cent bonds due in 1944 was made this week (ELECTRICAL WORLD, March 3, page 349). Inasmuch as the plan provides no underwriting agreement and no public offering, it was unnecessary to register the issue under the federal securities act. In addition to the new bonds offered in exchange for cash-maturing bonds, Virginia Electric & Power will deliver on and after July 2 $75 in cash, representing $25 interest due on July 1, and an extra $50 on each $1,000 bond. The new securities will be convertible, at the holder's option, for each $1,000 principal amount, either into $1,000 of series A 5 per cent bonds, plus $50 in cash, or 100 common shares of the company based on a conversion price of $10 a share.

A voluminous prospectus addressed solely to holders of the gold bonds has been issued in connection with the exchange offer. The report includes under its many divisions detailed charts and earnings statements of the company, characteristics of the new bonds offered, relations of the company to its subsidiaries and affiliates, auditors' reports, officers' compensation and copies of contracts with Engineers Public Service Company, Inc., and Stone & Webster Engineering Corporation.

O. D. Young Sees Limit to Government in Business

Characterizing the present struggle between business interests and the administration as a national tug-of-war, Owen D. Young, chairman of the board of the General Electric Company and president of the Academy of Political Science, addressed the semi-annual meeting of the academy late this week.

"In our present reaction," said Mr. Young, "and I think it is not unfair to call it such, there is some demand that the government, which makes the rules and acts as referee, shall take hold of the rope permanently itself. If that step be taken and the government becomes a permanent and effective actor on the rope, then we shall have a new situation in this country. New rules, yes, we should loyally accept them and abide by them; the government as referee, yes, with extended powers, more than we have dreamed of before; but the government as actor, as contestant with its own people, well, Americans will hesitate long, I think, before they permanently cross that great divide."

HESITATION

Indecision, even hesitation, creeps into the current thinking of business men as perhaps-imminent labor strife and doubts of industry's ultimate fate under NRA arise. Most recent indexes of trade volumes, all at least a week old, show little effect of this reaction so far. Electrical energy production continues higher, with current figures 20 per cent over last year, against an increase of 18.4 per cent in the week previous. Automobile output has reached new heights with an increase of 6,000 units over the previous week's production. Retail sales continue 25-50 per cent over last year's. Steel and lumber production rise. Freight carloadings for the week ended March 10 set a new high for the year.

Prices continue erratic, stocks drifting lower, bonds strengthening markedly. Commodities rally from the week's early lows with the passage of the Dies silver bill by the House.

Certainty that the administration will exert every effort to prevent impairment of its recovery program, whether by labor or capital, backs a favorable outlook against difficulties of the moment.

N.E.M.A. Assails Wagner Bill

"No shrewder method could be devised for forwarding the interest of the professional agitator, for introducing and magnifying formality in man-to-man relations or for breeding ultimate discord," says N.E.M.A. regarding one clause.

MAINTAINING that "every effort has been expended to assure rigid and fair compliance with the labor provisions" of its NRA code of fair competition and recognizing that "to this effort the industry probably owes its relative freedom from labor troubles," the board of governors of the National Electrical Manufacturers Association late this week went on record as in firm opposition to the Wagner bill now before Congress.

Specific hazards recognized

That measure, according to its stated purpose, would "equalize the bargaining" power of employers and employees, to encourage the amicable settlement of disputes between employers and employees. . . ." Specifically, the bill would create a permanent National Labor Board, whose power would enable it, among other things, to prosecute any inquiry necessary to its duties in any part of the United States by one or more of its members or by such employees as it may designate, according to N.E.M.A. No member would be disqualified from sitting as judge in any case, regardless of his previous connection, if any, with the initial steps of the proceeding.

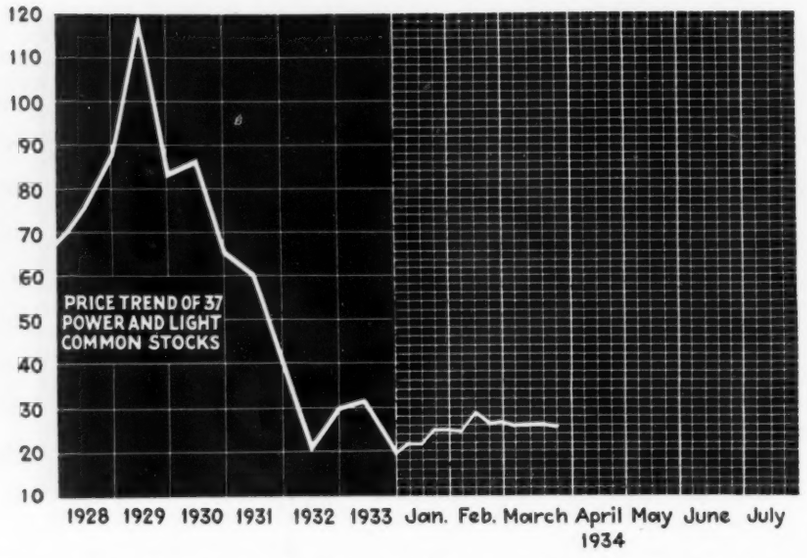
According to N.E.M.A., only acts by the employer are specified as unfair. The board would be further empowered to require the appearance within 24 hours of any person whom it or any of its employees has reason to believe is indulging in "unfair labor practice," by service of complaint stating the "general nature" of the charges. Amendment of the complaint could be made at any time before, during or after the hearing, and the board would not be bound by the rules of evidence prevailing in courts of law or equity. Cases could be reopened at will and the performance of its orders could be demanded by the board even if the case had been carried to a district court, unless the court should specifically issue a stay of execution. No court might enjoin the board in taking action or holding hearings under a complaint.

Why N.E.M.A. opposes it

N.E.M.A. opposition to the bill is based on the grounds that "the passage of the Wagner bill as written would provide the most potent weapon yet devised to provoke discord and jeopardize the future of the industry. Even its consideration at so critical a stage of industry progress tends to nullify the effort toward recovery by reason of the uncertainty generated. Its withdrawal would be to the advantage of every citizen in every walk of life save perhaps to the minority, who, by reason of self-interest, are urging its passage."

Asserting that under the bill as presently written, "no labor practice would be 'unfair' when operated by one who *asserts* he is a representative of employees," the association states that the bill would leave the board without authority to issue any order of any character against any labor organization or its agents with respect to the defined "unfair labor practices." Under the bill, provision is made that an applicant for employment may be compelled, as a condition of employment, to join a labor organization if it comprises at least a majority of the employees, while the employer is specifically prohibited from setting as a condition of employment that the applicant refrain from joining, the association states.

Stocks Decline Somewhat



In company with the general market, which has been beset by strike and slower business fears, electric light and power stocks lost ground this week. "Electrical World" index 25.5; last week 26.2.

Holding Company Hit in Standard G. & E. Suit

Reversing an order by Supreme Court Justice McGeehan, the Appellate Division of the New York Supreme Court ruled last week that the Standard Gas & Electric Company, Inc., must defend a stockholders' action brought in New York for an accounting of $30,000,000. Justice McGeehan had held that service on an employee in the company's transfer office was not valid on the ground that the company did no business in New York State and had no property there.

The plaintiffs are two stockholders who are suing on behalf of all stockholders. Also named as defendents are H. M. Byllesby & Company and the Byllesby Engineering & Management Corporation, subsidiaries of Standard Gas & Electric; the officers and directors of the companies at various times since 1923, and the members of the banking firm of Ladenburg, Thalmann & Company.

Stock values questioned

Fifteen transactions are alleged in which it is contended that the company had lost the sum for which the accounting is asked. It is charged that through the Byllesby control of Standard Gas & Electric the Byllesby interests were able to sell to the company for more than $10,000,000 stock alleged to have been worth only $500. Two of the alleged transactions involve the banking firm in asserted losses of $17,000,000.

In opposition to the appeal the Standard Gas & Electric Company claimed that the alleged transactions had been ratified by the stockholders and that one of the plaintiffs owned but 100 shares of stock, worth less than $1,000, out of a total of 3,377,000 shares.

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Central West Receiver

Following default on both interest and principal payments of several of its obligations, the Central West Public Service Company, owning and operating public utility properties in Iowa, Minnesota, South Dakota and Texas, has been placed in receivership upon petition of the Bussman Investment Company, St. Louis, holder of $25,000 of the company's three-year, 7 per cent gold notes.

Bond & Share Curb Asked

Following in the wake of a rate investigation instituted by Utah's Public Utilities Commission (ELECTRICAL WORLD, March 10, page 383), Joseph Chez, Attorney-General of the state, has challenged the right of Electric Bond & Share Company, New York, to carry out its existing contract with Utah Power & Light Company without first qualifying to do business in that state. Attorney-General Chez has brought suit in the name of the state, citing alleged payment by the Utah company of $688,961 to the parent company under a contract signed in 1929. The Attorney-General asks the court to impose a fine on Electric Bond & Share of not more than $5,000, to "oust it of all franchises and privileges of doing business as a foreign corporation" and that a prohibition be issued against its officers, agents and employees from engaging on behalf of Electric Bond & Share Company in any corporate business of the company within the state.

American Electric Power in Receivership

Unable to pay the semi-annual interest of $277,920 due last week on the $9,264,000 of debentures outstanding, American Electric Power Corporation has been placed in voluntary receivership. Elwyn Evans of Wilmington, Del., was appointed equity receiver. In filing its admission of insolvency and consent to a receivership, the corporation laid its difficulties to the "abnormal depression in general business" and the inability of subsidiaries to pay dividends in sufficient amount to satisfy current interest charges on outstanding indebtedness. The corporation, through stock ownership, directly and indirectly controls a number of companies, including the Pennsylvania Gas & Electric Corporation, Sioux City Gas & Electric Company and Iowa Public Service Company.

The present situation of the corporation, said L. E. Yeager, president of American Electric Power, in a letter to stock and debenture holders, has resulted from causes "entirely beyond the control of the management." Citing rate reductions forced by local governments and the 3 per cent federal electricity tax, Mr. Yeager added that no dividends have been received from Sioux City Gas & Electric since August 10, 1933, and none from Iowa Public Service since October 2, 1933.

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Northern States Pays Again

Resuming dividend payments on the class A common stock with a 25-cent disbursement, last previous payment November 1, 1933, directors of Northern States Power Company, Delaware, have also declared regular quarterly dividends on the 7 per cent and 6 per cent cumulative preferred issues.

Puget Sound Renews Notes

Authorized by the Olympia, Wash., Department of Public Works to renew $1,960,000 in promissory notes for which it had posted $3,430,000 of its refunding 1950 bonds, Puget Sound Power & Light Company was severely criticised by the department for its "economically unsound and financially unwise" pledging of a debtor's obligation to secure another obligation in a lesser amount.

National Small Appliance Campaign Launched

As a sequel to the "Better Light—Better Sight" campaign, the Edison Electric Institute has launched, in conjunction with the Heating Device Division of the National Electrical Manufacturers Association, a national program on electric table cookery. The promotional lighting activities will be limited until September and the objective will be to renew interest in the promotion of small heating and motor-driven devices and conduct co-operative programs with the local trades in order that electrical consumers may realize the valuable service rendered by the more modern electric tableware. Chairman George E. Whitwell of the sales committee has appointed a special national committee on the electric table cookery program consisting of D. M. DeBard of Stone & Webster Service Corporation, chairman; C. E. Swartzbaugh, president of Swartzbaugh Manufacturing Company and chairman of the Heating Device Division of the N.E.M.A.; R. W. Turnbull, General Electric Company; F. R. Kohnstamm, Westinghouse Electric & Manufacturing Company, and C. E. Greenwood, commercial director of the institute headquarters.

The program recognizes that there are many thousands of electrical consumers whose spending margins prevent investment in such electric items as the refrigerator, range and water heater and who will be directed to this market. The formal slogan chosen by the committee is "Electric Table Service Saves," and its activity will be backed by a monthly news medium called "Table Cookery Topics."

To Supply the Pennsylvania

Preparing for the supply of electric power to the Pennsylvania Railroad for the electrification of its trains from the Susquehanna River through Baltimore to Washington, the Consolidated Gas, Electric Light & Power Company, Baltimore, has awarded contracts in excess of $400,000 to the General Electric Company and Westinghouse Electric & Manufacturing Company (ELECTRICAL WORLD, February 10, page 234). The contracts are for substation equipment to be installed in a transformer substation to be located on the railroad right-of-way near Baltimore.

New York Metal Prices

	Mar. 13, 1934 Cents per Pound	Mar. 20, 1934 Cents per Pound
Copper, electrolytic	8.00	8.00
Lead, Am. S. & R. price	4.00	4.00
Antimony	7.50	7.65
Nickel ingot	35.00	35.00
Zinc, spot	4.725	4.725
Tin, Straits	54.25	53.60
Aluminum, 99 per cent.	23.30	23.30

Foster Wheeler Orders Up

Unfilled orders of the Foster Wheeler Corporation as of March 1 amounted to more than $4,000,000, the largest volume reported by the organization in 26 months. On December 31, 1931, unfilled orders amounted to $4,144,089. The company operated "in the red" all through 1933, with the largest part of the year's $746,820 loss being incurred in the first half year. Thus far in 1934 operations have continued at a loss, although the figures are said to have been considerably reduced from those of a year ago.

New N.E.M.A. Cost Study

In recognition of the importance of special factors in the porcelain lighting fixtures industry which must be considered in cost accounting, the National Electrical Manufacturers Association has appointed a special cost committee to make recommendations for evolving a standardized cost system to be presented to the industry for the purpose of effectuating its present code. At the same time an additional committee has been appointed to prepare a tentative draft for a supplemental code based on the needs of this division of the industry.

Norge on Full Production

With both Detroit and Muskegon plants working to capacity, and March unfilled orders the largest in the company's history, Norge Corporation announces the receipt of three orders totaling 149 carloads of refrigerators. "These three orders are concrete examples of what can be expected in 1934," states John M. Knapp, Norge vice-president and general sales manager. "In my visits to the leading cities in the South, East and Midwest I have found every evidence that this will be a banner year in the refrigeration industry."

Deny Investment Control

Denial of the power of the District of Columbia Public Utilities Commission to compel utilities to obtain approval of the commission before proceeding with major improvements to their plants was incorporated in an opinion issued last week by Corporation Counsel W. W. Bride. The opinion upsets plans of the commission to take a more specific control over the investments of local utilities in their physical properties. On January 13 the commission issued a tentative order requiring that the companies apply to it for approval of proposed extensions, replacements or retirements of physical properties in all cases of investments exceeding $10,000 in cost.

Major New Construction This Week

Iowa Public Service Company plans new transmission line in Black Hawk County.

Klausmann Brewery, St. Louis, Mo., plans extensions and improvements in 22 buildings. Cost about $1,000,000.

Power substation equipment, pumps, motors, regulators, conveyors, etc., will be installed at the Sayreville, N. J., plant of Titanium Pigment Company, a $1,500,000 project.

Motors, controls, regulators, conveyors, hoists, etc., will be installed by Crown Willamette Paper Company, Los Angeles, Calif., at cost of about $100,000.

Seguin, Tex., asks bids until April 4 for equipment for city-owned light and power plant, including waterwheel-generator, conduits and other apparatus.

Motors, controls, conveyors, regulators, electric hoists and other equipment will be installed at Syracuse, N. Y., plant of International Harvester Company. Cost $140,000.

Hamburger Distillery, Ltd., Pittsburgh, Pa., plans extensions and improvements in Brownsville, Pa., plant at cost of $125,000.

Until April 2, Detroit Lakes, Minn., asks bids for equipment for improvements in city-owned electric light and power plant.

Golden Age Brewery Company, Youngstown, Ohio, plans $100,000 expansion.

Manning, Iowa, will expend $135,000 for new city-owned light and power plant.

Union Light, Heat & Power Company, Covington, Ky., plans rebuilding of transmission lines over Licking River, from Covington to Newport, Ky.

Weston Cuts Losses

Net loss of the Weston Electrical Instrument Corporation for the year ended December 31, 1933, after taxes, depreciation and other charges, amounted to only $24,369, compared with $153,353 loss during the preceding year. For the quarter ended December 31 net profit after the same charges was $45,696, equal after dividend requirements on 34,800 class A shares to 17 cents a share on 160,583 no-par common shares, compared with net loss of $9,120 in preceding quarter and $14,114 loss in final quarter of previous year. Balance sheet of the corporation and domestic subsidiaries as of December 31, 1933, shows total assets of $3,414,931, comparing with $3,587,314 on December 31, 1932, and earned surplus of $719,748, against $772,069.

MEN OF THE INDUSTRY

G. W. Faller Returns to Colorado Utility

GUY W. FALLER, for many years prominently identified with the Henry L. Doherty utility interests, has been elected vice-president and general manager of the Public Service Company of

Colorado, to succeed the late Clare N. Stannard.

After spending two years at the Madison, Wis., properties he went to the Denver Gas & Electric Company and was the assistant superintendent of the company when in 1913 he was transferred to Amarillo, Tex., subsequently becoming vice-president and general manager. In 1923 Mr. Faller was recalled to Denver and when the Public Service Company of Colorado was formed in 1924 he was elected vice-president and director, in charge of outside properties, budget and publicity. Four years ago he resigned to become district manager of the Henry L. Doherty & Company securities department at Denver.

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DR. HUGH MAGILL has been elected president of the American Federation of Utility Investors, Inc., to succeed Chester D. Tripp, who became chairman of the executive committee.

H. D. JAMES, control expert and long a consulting engineer of the Westinghouse Electric & Manufacturing Company, has established in Pittsburgh an engineering consulting service specializing in industrial and building problems. Mr. James entered the employ of the Westinghouse company in 1904 and has been with the organization continuously since that time. In 1909 he assisted in the organization of the general engineering department and seven years later assisted in the organization and was appointed manager of the control engineering department. In 1927 he was promoted to the position of consulting engineer to handle the many intricate problems of control which arise in industry. He has to his credit approximately 150 patents on electrical and industrial devices and is an authoritative writer for technical magazines. Mr. James is one of the original fellows of the American Institute of Electrical Engineers and has been active in committee work for that society.

JULIUS S. RIPPEL has been elected a director of the Crocker-Wheeler Electric Manufacturing Company to succeed Leonard S. Horner.

FRED L. SHIMER, division manager of the Central Illinois Public Service Company at Marion, will be transferred to and assume the duties of manager of the statistical department in the company's general offices at Springfield.

C. O. ANDERSON, formerly connected with Leeds & Northrup Company, and more recently with the Claud S. Gordon Company of Chicago, has recently been elected vice-president and appointed general manager of Pyrometer Service & Supply Corporation of Cleveland, a subsidiary of Claud S. Gordon Company.

R. J. COE has been appointed assistant electrical engineer of the New England Power Association with headquarters at Boston, Mass. Mr. Coe was graduated in electrical engineering from Cornell University in 1925 and after several months with the General Electric Company in the testing departments at Schenectady and Erie, he joined the New England Power Company's operating department at Worcester, Mass. He was transferred a year later to the electrical engineering department and has been located at Boston most of the time since the engineering staff offices of the system have been in that city.

ALBERT L. MAILLARD, prominently identified with the engineering profession in the Southwest, has been appointed head of the new air-conditioning department of the Kansas City (Mo.) Power & Light Company. Mr. Maillard served as chairman of the Southwest Power Conference held three years ago and also as chairman of the Southwest Power and Mechanical Exposition held in connection with that conference. He has maintained consulting engineering offices in Kansas City for some time. Mr. Maillard is a member of the American Institute of Electrical Engineers.

EVERETT E. STONE, for twenty years a member of the Massachusetts Public Utilities Commission, and LEWIS E. MOORE, consulting engineer formerly connected with the Department of Public Utilities, have formed the firm of Stone & Moore for the practice of engineering.

EDGAR KOBAK, who resigned last month as a vice-president of the McGraw-Hill Publishing Company, Inc. (ELECTRICAL WORLD, February 24, page 315), has been elected vice-president in charge of sales of the National Broadcasting Company. In assuming these new executive duties, Mr. Kobak is remaining in the field of endeavor which has long been his forte—sales and advertising. At the present time he is president of the Advertising Federation of America and chairman of the Advertising Review Committee, composed of leading national advertisers, publishers and advertising agencies. Mr. Kobak will head the entire sales organization of the National Broadcasting Company, with divisions in New York, Chicago and San Francisco reporting to him.

R. C. CLIFTON has been named manager of the Ida Grove properties of the Iowa Public Service Company, Fort Dodge, to succeed W. J. Fawcitt, deceased.

H. B. COBBAN of Miami, Okla., general manager of the North East Oklahoma Railway Company, was elected

president of the Oklahoma Utilities Association at the annual convention held recently in Tulsa.

J. E. NORTH, for many years associated with the Cleveland Electric Illuminating Company, has been made director of domestic sales. In this position Mr. North will devote himself to intensifying co-operative promotion of domestic electric appliance sales and domestic wiring and lighting. He is

serving at the present time his ninth consecutive term as president of the Cleveland Electrical League.

WESLEY T. HARRISON, formerly secretary of the Alumni Association of the Stevens Institute, Hoboken, N. J., has joined the engineering staff of the commercial engineering department, Westinghouse Lamp Company, Bloomfield, N. J. Mr. Harrison will serve in the capacity of an illuminating engineer.

LEROY M. EDWARDS, general counsel for the Los Angeles Gas & Electric Corporation, has been elected to the board of directors to succeed August Schilling.

ROGER P. INGALLS, formerly sales manager of the Simplex Electric Heating Company, Cambridge, Mass., and more recently associated with the Hewitt Electric Heating Company, Arlington, Mass., as president, has severed his connection with the latter organization and joined the staff of W. L. Thompson, Inc., Boston, Mass., as a specialist in General Electric commercial refrigeration.

H. G. PERKINS, assistant to the president of Kelvinator Corporation, has been made a vice-president. He also is a director of the corporation. Joining the staff of Kelvinator in 1929 after a varied experience with a number of large industrial organizations, he has been closely identified with the formulation and administration of the company's policies since that time.

WILBUR G. HUDSON has been appointed chief engineer of the Link-Belt Company's Chicago plant. A graduate of Cornell University, Mr. Hudson entered the employ of the Link-Belt Company at Philadelphia as a draftsman. Advancing in the ranks, he assumed broader responsibilities and subsequently was appointed general superintendent of erection. After leaving the Link-Belt organization in 1908 he held several executive offices, including the vice-presidency of the Guarantee Construction Company and the presidency of the Wilbur G. Hudson Corporation. In addition to his work in materials handling, Mr. Hudson has also been vice-president and chief engineer of the Curtiss-Wright Airport Corporation, in charge of the design and construction of its airports.

E. W. ASHMEAD, for the past several years connected with the Commonwealth & Southern Corporation, has been appointed to the recently created position of manager of sales of the Tennessee Electric Power Company. Mr. Ashmead's duties embrace supervision over all sales and new-business activities of the company.

OBITUARY

Walter D'Arcy Ryan

Walter D'Arcy Ryan, famous General Electric illuminating engineer, who died last week (ELECTRICAL WORLD, March 17, page 423), was universally regarded as the man who first made artificial illumination both a science and an art. He introduced and firmly established new concepts and practices in all fields of electric lighting until the modern era in artificial illumination had become an accepted reality. Every great illumination spectacle of the last quarter century was planned and executed by Mr. Ryan, working through the illuminating engineering laboratory of the General Electric Company, which he created and directed for many years.

In 1892 he entered the old Lynn works of the Thomson-Houston Electric Company. In 1896 he was promoted to the position of superintendent of test men in the West Lynn works of General Electric and at the same time made various engineering investigations. Shortly after he was made a commercial engineer, and it was while holding this position that he decided to specialize in illumination.

Conceiving at once of an illuminating engineering laboratory, an altogether new idea to his superiors, he finally obtained an appropriation of $10,000 to start such a project, and on January 1, 1899, the illuminating engineering laboratory was created at the River Works at West Lynn. Four years later he was formally designated illuminating engineer. In 1909 the laboratory was moved to Schenectady, its facilities greatly expanded and its influence recognized both within and without the General Electric Company. Mr. Ryan was asked to direct the illumination for the Panama-Pacific exposition. Discarding all existing theories as to spectacular lighting, particularly the idea of outlining the various buildings by rows of incandescent lamps, he proposed to illuminate the façades of the structures from light sources which were to be concealed from view. The art of floodlighting developed directly from this scheme of lighting.

Between 1915 and 1930 Mr. Ryan was called upon repeatedly to plan and install spectacular lighting effects. The Century of Progress Exposition at Chicago last year was well advanced when Mr. Ryan was asked to take charge of the lighting features and he put into effect an illumination spectacle which made the big fair as much of a success at night as it was in the daytime.

Since 1932 Mr. Ryan had been a consulting engineer of the General Electric Company, devoting himself particularly to the activities of the illuminating engineering laboratory.

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ARTHUR C. EATON, hydraulic engineer for the New England Power Company, died March 6 at his home in Worcester, Mass. Mr. Eaton was 50 years of age and had been prominent in many of the hydro-electric power projects installed by his company in all parts of New England.

WILLIAM S. SOPER, one of the pioneers of electrical development in northern New York, died at his home in Hammond February 5, after an illness of several months. He was 76 years of age. Mr. Soper was one of the founders of the Hammond Light & Power Company and operated the Hammond plant until it was taken over by the Northern New York Utilities, Inc., a few years ago.

JAMES E. JORDAN, superintendent of distribution for the El Paso Electric Company, died suddenly February 21 as the result of an operation. Mr. Jordan had been connected with the El Paso utility since 1919, and prior to that date had spent ten years with the Savannah Electric Company.

KARL E. NUTTING, president of the Nutting Electrical Company and vice-president and treasurer of the Engineering Equipment and Industrial Electric Supply Companies, Muncie, Ind., died recently in that city as the result of injuries sustained in an automobile accident. He was 47 years of age.

MAJOR W. H. WARDWELL, consulting engineer of Montreal, died in that city March 15, at the age of 60. A native of Buffalo, N. Y., Major Wardwell moved to Canada early in life and was connected with the development of the Shawinigan water-power project. Upon the completion of that undertaking he transferred his interests to Montreal, where he established himself as a consulting engineer.

NEW EQUIPMENT

Vacuum Contact Device

For use in atmospheres containing explosive gases, the General Electric Company, Schenectady, has introduced the type HBA vacuum-contact device for auxiliary potential control service. It is a single-pole, double-throw contactor inclosed in an evacuated heavy glass tube, one end of which is sealed to a metal bellows which permits movement of one contact between and to either of two stationary contacts supported in the tube. Excessive voltage surges at interruption of circuit by the device are controlled by special contacts and the use of external condensers across the load terminals. The unit is inclosed in a steel container. The rating is 15 amp., 250 volts, with 10 amp. interrupting capacity at 115 and 230 volts, 60 cycles, and 125 and 250 volts d.c.

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SOLDERLESS SERVICE CONNECTORS of hard-drawn bronze are announced by the H. B. Sherman Manufacturing Company, Battle Creek, Mich., for making line taps and all purposes where reliable electrical and mechanical solderless connections are required. They are available in eight sizes in either large fillet or small chamfered head.

SINGLE-PHASE INDUCTION MOTORS, type PM, of two-pole center drive, shaded-coil type construction, have been announced by the Signal Electric Company, Menominee, Mich. They are for use where small power and starting torque are required and are available with oil-less bearings for a.c. only. They develop 1/1,000 hp. with full load speed at 2,300 r.p.m. and weigh 1¼ lb. They can be had with gear reduction of 27.67-1 and 48-1.

INSULATED FLASHLIGHTS in both spot- and spread-light types and identified as Bond "Voltpruf" are being introduced by the Bond Electric Corporation, Jersey City, for work around transmission lines, busbars or other electrical circuits. They have a heavy, ribbed fiber case, devoid of metal parts on the outside, insulated up to 16,000 volts so that neither injury to the operator nor internal damage will result from accidental contact with electrical circuits.

Improved Welding Timer Expands Spot-Welding Use

Radically new and improved electronic controllers suitable for use in spot welding and identified as "Ignitrons" have been announced by the Westinghouse Electric & Manufacturing Company. These controllers make it possible to weld dissimilar metals, special alloys and light materials where accurate time control is essential. Ignitron power tubes, type KU-637, are of mercury pool cathode type and can be connected in series with 220- or 440-volt welding machines. They are cabinet mounted above the control equipment of five grid-glow tubes, initiating relay controlling energy supply to grid-glow tubes and protective relays to delay functioning until tube filaments are heated. Three of the grid-glow tubes, type KU-627, time the weld operation; the first or initiating tube functions to determine the adjustable point on the voltage wave at which welding begins; the others are "start" and "stop" tubes.

The two other grid-glow tubes, type KU-628, are control tubes governed by the timing tubes. These pass controlling current to the ignitron power tubes, which are entirely inactive when no current is being drawn for welding and until current from the control tubes is passed into the mercury pool cathode from the control tubes via the ignitron electrode. The whole installation is compact and the power tubes have no peak current limitations. This permits high momentary current flow without injury. Welding period may be varied from one cycle upward in 1-cycle increments, and special apparatus can be provided for a minimum period and increment of one-half to one-fourth cycle. Adjustment is made from a convenient remote-control cabinet.

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RENEWABLE FUSES incorporating a design principle that prevents blowouts until the current overload has continued for a sufficient space of time to be dangerous have been announced by the Jefferson Electric Company, Bellwood, Ill., under the name Jefferson "Super-Lag." To the fuse links are attached lag plates which absorb the heat generated by an overload, retarding the blow until it persists long enough to endanger the equipment. Convenient and durable, "Super-Lag" fuses are made in all standard ratings in both knife-blade and ferrule types.

INDIRECT WALL BRACKET "PIN-IT-UP" LAMPS have been introduced by the Railey Corporation, Cleveland, which are suitable for home or commercial use where low-cost lamps of modern design are needed. They employ 250-watt G-30 "Mazda" indirect bulbs to provide glareless light. The shade, made entirely of aluminum, is constructed so that some light is permitted to escape from apertures between the petticoat type reflectors, so the over-all appearance is that of a shade of translucent glass with each reflector capped by a metal ring.

SELF-CONTAINED ROOM COOLING UNITS of approximately 1-ton refrigerating capacity have been introduced by Servel, Inc., 51 East 42d Street, New York City, for homes, offices or small commercial installations where simplicity and portability are primary factors. The units are self-contained except for electrical connection for the 1-hp. motor, and water and drain connections. Designed for summer use only, the units cool, dehumidify and circulate the air. The cabinet used is 66½ x 14½ x 31 in.

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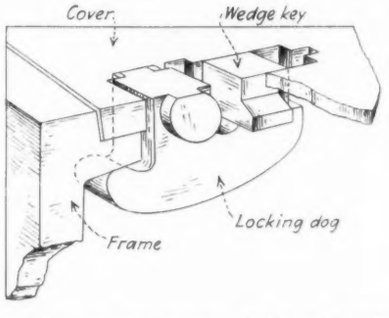
Manhole Covers Now Lock

No rattling and bouncing from traffic passing over is stated as the feature of a new type of locking manhole cover announced by the Semi-Steel Castings Company, St. Louis, Mo. Three of the locks shown in the sketch are normally supplied in each cover, spaced 120 deg.



apart, but covers are available with only two, diametrically opposite. Referring to the sketch, the locking dog is dropped through the slot in the cover and its extended lip hooks under the flange of the cover frame. The wedge key is then inserted and pushed back in its groove in the cover to hold the locking dog rigidly in place. It is said by the manufacturer that the covers can easily be unlocked when frozen over or after they have been covered with concrete or asphalt.